An International Analysis of Cash Holdings: Understanding the Role of Losses

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Biographical Note

João André Cerdeira Lopes de Carvalho was born in Guimarães, Portugal in February 26th, 1994. At the age of eight, he began his soccer career, which today keeps at a semi-professional level. In 2016, he completed his bachelor's degree in Management at the University of Minho. Throughout his undergraduate degree, he was actively involved in several activities as a collaborator of the School of Economics and Management at the University of Minho and he was part of the implementation of Refood's project at his hometown. In September 2016, he got enrolled in his Master course in Finance at Faculty of Economics of University of Porto. Along the second year of the master course, he executed a professional activity as Financial Controller at Ferro – Grupo Ferpinta.

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Abstract

Decisions on the amount of cash have been playing an extremely important role in firm's financial decisions. Several studies have emphasized the dramatic increase in cash holdings in the last few years. However, according to the literature (e.g. Bates et al, 2009), we document that the increase in the amount of cash was more pronounced for firms reporting negative cash flows. This project intends to understand which reason justifies firm's decisions in terms of cash holdings, observing differences in behavior based on the information of the respective cash flow. We further test whether Hofstede's cultural dimensions explain these variations in cash holdings. Moreover, we evaluate the impact exerted by financial constraints on negative cash flows firms in terms of cash.

The sample consists of 335,355 company-year observations from 45 countries between 1992 and 2016. We find evidence that support that loss firm's cash decisions are linked to a heightened concern about cash flows. We also note that the increasing persistence of losses exacerbates the demand for cash. These results are consistent with our initial hypotheses. Based on the firms countries cultural characteristics we find that the main impact of individualism (negative), masculinity (positive), uncertainty avoidance (positive) and long-term orientation (positive) is influenced with the magnitude of negative cash flows. Finally, we explore the importance of financial constraints on cash decisions. However, the influence of national culture variables is impacted by the magnitude of negative cash flows. These results are robust to alternative specifications, supporting that the precautionary motive is the main driver for the differences in cash holdings between loss and profit firms.

Key-words: Cash holdings; Precautionary motive; Transaction motive; National culture; Financial constraints

JEL-Codes: G3, G32, G39

Resumo

As decisões relativas ao montante de caixa têm vindo a assumir um papel de extrema importância no seio das decisões empresariais de carácter financeiro. Diversos estudos documentam um aumento significativo dos montantes em caixa. No entanto, de acordo com a literatura (ex: Bates et al., 2009), documentamos que o aumento dos montantes de caixa é mais acentuado para empresas que reportam cash flows negativos. Este projeto pretende perceber qual o motivo que justifica as decisões das empresas em termos da definição dos montantes de caixa, percebendo as diferenças nos comportamentos tendo como base o sinal do respetivo cash flow. Adicionalmente, testamos o poder explicativo das variáveis culturais de Hofstede na explicação das variações registadas nos montantes de caixa. Também, avaliamos o impacto que as restrições financeiras exibem no caixa em empresas com cash flows negativos.

A amostra é composta por 335,355 observações empresa-ano provenientes de 45 países compreendidos entre o ano de 1992 e 2016. De acordo com os resultados obtidos, encontramos evidências que comprovam que as decisões de caixa das empresas que reportam perdas estão vinculas a uma precaução adicional com os cash flows. Podemos mesmo verificar que o aumento da persistência das perdas exacerba a procura por cash. Estes resultados são consistentes com as nossas hipóteses iniciais. Obtivemos também resultados esclarecedores relativamente ao impacto da cultura nacional no montante de caixa. Não obstante, o impacto isolado das variáveis individualism (negativo), masculinity (positivo), uncertainty avoidance (positivo) e long-term orientation (positivo) é influenciado pela magnitude de cash flows negativos. Por fim, demonstramos a importância das restrições financeiras nas decisões de caixa. A magnitude das variáveis culturais sofre também o impacto derivado do sinal do cash flow. Estes resultados são, na sua maioria, robustos a especificações alternativas, provando que o motivo de precaução é o principal fator para as diferenças na relação dos montante de caixa entre empresas com resultados positivos ou negativos.

Palavras-Chave: Gestão Liquidez; Motivo Precaução; Motivo Transação; Cultura Nacional; Restrições Financeiras

Classificação JEL: G3, G32, G39

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1. Introduction

Over the last two decades, several questions on the reasons for firms to hold cash have been extensively debated. Cash is an important component of firms' balance sheet being the most liquid and one of the least profitable asset. Therefore, understanding the cash policy of a firm becomes a crucial issue that managers need to cover in order to improve its strategy of corporate financial management, which might affect the firm. The importance of cash is highlighted through the dramatic increase over the last years in corporate cash reserves. Bates et al. (2009) suggest that the average cash ratio, measured as the ratio of cash over assets, more than doubles from 10.5% in 1980 to 23.2% in 2006. Based on a sample of US firms, they find a significant yearly average increase of 0.46%, more pronounced for the subset of firms reporting negative operating cash flow. This becomes particularly important considering that firms with persistent operating losses behave differently from companies with positive cash flows in terms of corporate financial policy, including cash policy (Dennis and McKeon, 2017). Dennis and McKeon (2017) find that, between 1970 and 2015 in the US, average cash holdings increased 90% in firms with positive cash flows and 580% for companies with negative cash flows.

The differences in cash policy decisions according to the sign of cash flow is also noted in our international sample. Between 1992 and 2016, we report that cash holdings of negative cash flow firm have increased roughly 39% against 30% for firms reporting positive cash flows. The motive that best explains this difference in corporate financial behavior remains not entirely known. Indeed, four primary motives for firms to hold cash are identified in the economic literature. The transaction motive predicts that firms should hold a level of cash that optimizes firm's performance, avoiding the transaction costs associated with external markets or selling assets (Keynes, 1936). The precautionary motive defends that firms hold cash as a buffer, to prevent against adverse shocks or even to get benefits from good investment opportunities (Keynes, 1936). Under the agency motive, the existence of asymmetric information and conflicts of interest between managers and investors would affect the amount of cash that firms hold (Jensen, 1986). When these problems are exacerbated, firms will prefer internal cash financing rather than external financing (Myers and Majluf, 1984). The last is the tax motive, which states that firms would prefer to hold cash overseas to avoid tax payments associated with repatriating income (Foley et al., 2007).

This research first aims to understand which of these theories best describes the cash policy of negative operating cash flow firms, or if other explanations can be put forward to better understand their cash holding behavior. Although Dennis and McKeon (2017) have done something in line with what has been described, their empirical analyses focus only on US firms. However, as shown by several authors, as Jiang et al. (2016), the negative operational cash flows are not a particular phenomenon of US firms. Moreover, not only the magnitude of these negative operating cash flows has been increasing (Denis and McKeon, 2017), as well losses have become more persistent (Joos and Plesko, 2004).

This study also attempts to complement the current literature by including national culture as a determinant for negative cash flow firm's cash policy decisions. The inclusion of national culture has been growing on important corporate financial decisions, such as Capital Structure (Chui et al., 2002), Dividend Payout Policy (Shao et al., 2010) and Cash Holdings (Chang and Noorbakhsh, 2009; Chen et al., 2015). Since cultural values influence managers, Chen et al. (2015) defend that cash holdings decisions cannot be effectively studied without considering national culture. Therefore, beyond the traditional firm-specific control variables, the country's specific characteristics are also taken into account, in particular, its national culture. As a proxy for national culture, the Hofstede's (1980, 2001) cultural dimensions is used, in particular, individualism, masculinity, uncertainty avoidance and long-term orientation. Besides the influence of these dimensions on the sample used by Chang and Noorbakhsh (2009) and Chen et al. (2015), the goal is to test the impact of these cultural variables on cash holdings policy. This allows understanding the role of losses in the interaction between cultural variables and cash holdings.

Opposite to the vision of a perfect market environment advocated by Modigliani and Miller (1958), firms in a real-world need to hold cash in order to cover immediate expenses (e.g. expenses arising from their current activity or from investment projects), particularly those that face frictions when accessing external finance. Indeed, financial literature defines those firms as financially constrained. There are several measurements of financial constraints, such as the case of the methods used by Almeida et al. (2004), Whited and Wu (2006) and Kaplan and Zingales (1997). Since firms with negative net income are more prone to be financially constrained (Almeida et al., 2004), we argue that these firms respond with more cash to prevent from future cash flow shocks. This is in accordance with Han and Qiu (2007), which find that constrained firms increase their demand for cash in response to an increase in cash

flow volatility. In addition, we also test the impact of constraints on national culture traits for negative cash flow firms.

Therefore, we extend the current literature by (i) studying the role of losses in cash holdings for several countries, allowing to make cross-country comparisons, as well the possibility of having a deeper knowledge of the reasons behind this cash policy behavior; (ii) include in the analysis the impact of the national culture, which controls for some constraints on conclusions due to differences between countries; (iii) analyze the cash policy behaviour of negative cash flow firms, according to their financial constraints.

The methodology follows a double-clustered model based on panel data with the inclusion of both firm-specific control variables and natural culture dimensions. The research sample is comprised of 45 countries, from 1992 to 2016, resulting in 335,355 firm-year observations.

Our findings suggest a strong effect of both precautionary and transaction motive on the cash ratio of negative cash flow firms. Nonetheless, the positive relation of masculinity and long-term orientation with cash holdings and the negative relation of individualism to the latter confirm the role of national culture in explaining the level of cash holdings. Indeed, we prove that the national culture influences the precautionary motive to firms hold cash. Meanwhile, we find that uncertainty avoidance is not significant in explaining the behavior of cash policy firms for our sample. In additional tests, we show evidence that constrained firms tend to adapt their cash holdings to changes in firm-risk. This segment of firms display an additional precaution in their cash policy due to their financial instability.

The structure of this dissertation will proceed as follows. We start with the second chapter by presenting the existing literature regarding cash holdings, which presents the motives to hold cash, the main theories and the empirical literature associated. We proceed introducing the current literature on the relation of cash holdings to losses and to the national culture. In the third chapter, our hypothesis are scrutinized. Chapter four describe the variables used and the methodology. The chapter fifth presents the results and its interpretation in line with our hypothesis and current literature. Finally, chapter sixth provides the final remarks, limitations, and suggestions for future research.

2. Literature Review

In this section, the main theories and findings on cash holdings are presented. It is divided in three different subsections each focusing on the main research theories about the subject. The first provides an overview of cash holdings, presenting the main motives and theories related to holding cash. This section end with the empirical evidence related with the main determinants of cash holdings. The second subsection presents some evidence regarding operating losses and the association with cash holdings. The last subsection defines national culture while displays the empirical evidence that connect the different dimensions to cash holdings.

2.1. Cash Holdings

Cash holdings can be defined as the portion of firms' assets, which exhibit a high degree of liquidity. These are of crucial importance for the daily operation of every company, as provides the means to facilitating the payment of its obligations.

One of the central issues of financial management is to ensure that the company has an adequate level of liquid assets, in order to invest in valuable projects and maintain its daily operations. However, the decision to hold cash carries both benefits and costs to firms and its shareholders. Ferreira and Vilela (2004) documented that cash holdings allow firms to undertake valuable projects regardless the unexpected financial constraints. In this case, the amount of cash is influenced by the degree of access that firms have to external capital markets. Chen and Chuang (2009) show that cash may reduce transaction costs and can minimize the firm's cash flow volatility. On the other hand, the decision to hold excessive amounts of cash carries costs (e.g. opportunity cost of holding cash) or may hide the loss of performance (Ferreira and Vilela 2004).

2.2. Theoretical Motives for Holding Cash

In a world of perfect capital markets, as assumed by Modigliani and Miller (1958), decisions regarding cash policy would be irrelevant. Firms facing a shortage of internal resources would simply access external markets, cut dividends or even sell their assets without affecting the

firm's value (Modigliani and Miller, 1958). Nevertheless, market imperfections do exist creating different motives for firms to hold cash, according to their needs. Keynes (1936) and Jensen (1986) clarify four possible motives for a firm to hold cash: (i) the transaction cost motive, (ii) the precautionary motive, (iii) the agency motive and (iv) the tax motive.

The transaction cost motive documented by Keynes (1936) states that firms should have a certain level of cash to support its business operations, minimizing the costs of liquidating assets and the transactions costs associated with raising external finance. Opposite to what was presented by Modigliani and Miller (1958), the imperfections of the market can make it cheaper to hold cash rather than raise it on the market. Therefore, the transaction motive can be seen as a trade-off motive, since firms have a trade-off between minimizing the transaction costs of raising cash and minimizing the opportunity costs of holding cash (Kim et al., 1998).

William Baumol (1952) developed a model that relate the demand of money with transaction costs, which is further explored by other researchers. Relying on the theoretical foundations of Baumol (1952), Opler et al. (1999) find that the optimal level of cash is given by the intersection of the marginal cost of having liquid assets and the marginal cost of being short on liquid assets. Several models examined some firm characteristics that were associated to the transaction motive to hold cash, as the firm size, cash flows, investment opportunities, dividends and leverage (Opler et al., 1999; Bates et al., 2009). Opler et al. (1999) find evidence that large firms will hold fewer levels of cash, as these firms have economies of scale associated with transaction costs. Kim et al. (1998) report that free cash flow is a determinant of cash holdings given that firms can use it as a substitute for cash. Regarding non-cash liquid assets, Ozkan and Ozkan (2004) find that it influences the level of cash because it can be a substitute for cash.

Similar to the transaction motive, the precautionary motive is first introduced by Keynes (1936). Under this motive, cash is seen as a safety or self-insurance measure against times where external finance is costly or even unavailable (Myers and Majluf, 1984). Therefore, firms tend to accumulate cash to prevent cash shortages due to adverse business shocks or unanticipated future necessities. Ozkan and Ozkan (2004) show that managers tend to hold cash in order to prevent losing valuable investment opportunities due to a cash shortage. This shortage of cash can also motivate the bankruptcy of the firm. Opler et al. (1999) show that cash holdings may reduce the expected costs related to financial distress.

Through a theoretical model, Miller and Orr (1966), find that the demand for cash increase along with the increase in cash flow volatility. Bates et al. (2009) add that not only firms with riskier cash flows but also firms with poor access to external capital tend to hold more cash. Almeida et al. (2004) further examine the relation between the accumulation of cash and the presence of financial constraints. Their results suggest a positive cash-cash flow sensitivity, which means that constrained firms tend to increase their liquid assets. Opler et al. (1999) and Ferreira and Vilela (2004) find that the level of capital markets development is negatively related with cash holdings, which is supportive of the precautionary motive to hold cash. Additionally, a negative relation between capital expenditures and cash holdings has been reported (Stulz, 2007; Bates et al. 2009). This happens because capital expenditures can create assets that could act as a collateral, therefore increasing the debt capacity (Stulz, 2007). Firms with more debt capacity tend to hold less cash (Bates et al., 2009). The precautionary motive also predicts that dividend paying firms are less risky and therefore have lower levels of cash. (Opler et al., 1999 and Ferreira and Vilela, 2004).

The agency theory, documented by Jensen (1986), is also seen as a motive that explains the level of firm's cash holdings. The agency motive refers to the influence exerted on cash holdings by the conflict between managers and the principal (shareholders and debtholders). Jensen (1986) refers that firm managers have an incentive to stockpile cash, rather than increase the payout to shareholders. Furthermore, self-interested managers have a preference to increase their utility at expense of shareholders (Jensen, 1986). In this case, the manager would overinvest in order to increase the firm size or have a greater discretionary power within the firm. The agency problem is more pronounce for firms with large free cash flows and limited investment opportunities (Jensen, 1986; Dittmar et al., 2003). Dittmar and Mahrt-Smith (2007) reported that when agency problems are more severe, the value assigned to an additional dollar of cash is lower.

The notion of cash being wastefully spent by managers is widely explored in the literature, however relating it to agency problems is not easy. The solution in most studies is to rely on proxies, mainly the level of shareholder protection and measures of corporate governance. Regarding shareholder protection, Dittmar et al. (2003) and Guney et al. (2007) find that this variable has a negative relation with cash holdings, considering that firms in countries with poor shareholder protection tend to hold the double of cash than firms in countries with good shareholder protection. Harford et al. (2008) found a relation between corporate

governance and cash holdings. Firms with scarce corporate governance hold more cash and these firms tend to spend their cash quickly. Harris and Raviv (2008) show that a larger board provide optimal monitoring when managers' opportunities to consume perquisites are high.

The last motive that can justify the level of cash holdings by firms is the tax motive. This concerns to the repatriation of income of foreign subsidiaries to the home country of multinational firms. Foley et al. (2007) find strong evidence in the US consistent with taxes on foreign earnings affecting cash balances. This evidence is stronger for firms that neither have attractive investment opportunities nor are financially constrained in their home country. Therefore, US firms with higher repatriation tax costs have larger cash holdings. Faulkender et al. (2017) defend that some firm characteristics presented in the study of Bates et al. (2009) only explain corporate cash associated with precautionary motives in the variation of domestic cash. Denis and Mckeon (2017) suggest that the tax motive does not influence the increase in cash holdings for companies with negative cash flows. Only 8.5% of their sample of firms reporting negative operating results also report foreign income.

The motives above represents the basis for the three theories in the field of corporate finance, which explain the firms' characteristics that have an influence on cash holdings. The first two motives are the most mentioned in the financial literature.

2.3. Cash Holdings Theory

Corporate cash holdings are affected by different firm-specific characteristics depending on three advanced theories: the Trade-Off theory, Pecking Order theory and Free Cash Flow theory. Therefore, the rationality behind each of the theories is explored in the next sections.

2.3.1. *Trade-Off Theory*

The trade-off model is based on the assumption that firm's management is always concerned with the maximization of the shareholder value. Therefore, they will pursue an optimal level of cash by weighting the trade-off between the marginal benefits and marginal costs of having cash (Ferreira and Vilela, 2004).

According to Opler et al. (1999), cash holdings can efficiently reduce the likelihood of financial distress, since in the case of unexpected decrease in firm's cash flow or even some

capital market constraints, cash would act as a reserve. Having cash allows companies to save on transactions costs on the access of capital markets and avoid the liquidation of assets to meet obligations. Moreover, sufficient cash holdings benefit firms that are financially constrained ensuring the achievement of an optimal investment policy, by reducing the external dependence. (Kim et al., 1998; Ferreira and Vilela, 2004).

Nevertheless, holding cash has associated a number of costs. First, there is an opportunity cost associated with cash; given it has a lower return when compared to other investments (Dittmar et al., 2003). Second, Dittmar et al. (2003) also highlight the issue of fees paid to access external financing, namely the transaction costs. Third, Opler et al. (1999) defend that agency problems can arise when cash levels are high. Therefore, according to the Trade-Off theory each firm reach their optimal level of cash by the intersection between the marginal curve cost of holding liquid assets and the marginal curve cost of being short on liquid assets.

2.3.2. *Pecking-Order Theory*

The pecking order theory assumed that firms prefer one type of financing above others when financing investments (Myers, 1984). The key aspect in this theory is the argument that managers (insiders) own more information and knowledge about the firm value than potential investors (outsiders) do. This information asymmetry between managers and shareholders increase the costs of access external markets (Myers and Majluf, 1984). Therefore, in the presence of asymmetric information the firm follow a so-called hierarchy of financing policies. Internal funds assumes the first option to finance investments opportunities, followed by debt and equity issuance (Myers, 1984). If internally generated funds (operating cash flows) are sufficient to fund new valuable investment projects, the company might choose to either lower its debt or accumulate cash. Otherwise, firms should use accumulated cash holdings to finance new projects and, if need, they can issue debt. This preference order arises as method to reduce asymmetric information costs.

2.3.3. *Free Cash Flow Theory*

The free cash flow theory (Jensen, 1986) is based on the notion that managers have incentives to hold larger amounts of cash, thus challenging the assumption about an optimal level of

cash holdings. The decision of firms may diverge from the amount of cash that maximize shareholders' value since managers could use cash for other purposes (Jensen, 1986). According to the model, cash holdings can be used to increase managers' benefits. This occurs because it increase manager's discretionary power to finance new investments that would not have been approved by the capital market. In addition, excess cash increases managers' financial flexibility and reduces the pressure to improve their performance (Ferreira and Vilela, 2004). Ultimately, if shareholders believe that managers are hoarding cash for non-identifiable reasons they would downgrade the stock, undercutting the firm value.

2.4. Empirical Evidence

Since cash holding became an active topic in liquidity research, numerous studies have focused on assessing the motives and determinants of cash holdings across different countries and industries. Bellow, we present the most important empirical studies in this field.

Lamont (1997) confirms that cash matters in order to take advantage of investment opportunities. The author found that when oil sector firms are exposed to business shocks, they tend to reduce investment as the cash holdings decrease.

Kim et al. (1998) in an empirical study based on the trade-off model analyzes the benefits and costs of holding cash, based on a sample of 915 US industrial firms. The authors find that the amount of cash is an increasing function of the cost of external finance, volatility of future cash flows and the profitability of future investment opportunities. Thus, growth opportunities, cash flow volatility and lower profitability have a positive relation to cash holdings. Although this is not always significant, firm size seems to have a negative relationship with cash holdings. If it is considered the positive relation between firm size and the access to capital markets these findings are consistent with the transaction cost model (Kim et al., 1998).

Opler et al. (1999) were the first to study the determinants and implications of cash holdings among a sample of publicly traded U.S. firms from 1971 to 1994. They systematically find that smaller firms, firms with significant growth opportunities and firms with more volatility on cash flows tend to hold more cash. On the contrary, firms with higher credit quality tend

to hold fewer amounts of cash. Their findings are in accordance with the precautionary motive to hold cash. Moreover, Opler et al. (1999) do not find a significant relation to other well-known motive, the agency costs motive.

At an international level, Dittmar et al. (2003) developed a study with respect to international corporate governance and corporate cash holdings. For a single-year sample of 45 countries with more than 11,000 firms, the authors find a negative and strong association between shareholder rights and cash holdings. Indeed, firms in countries with the lower protection of shareholder rights tend to hoard twice as much cash than firms in countries with good protection of shareholder rights (Dittmar et al., 2003). Therefore, they conclude that agency cost is an important determinant of corporate cash holdings. Chang and Noorbakhsh (2006) found similar results for a sample of 48 countries, i.e. a negative association between shareholder rights protection and cash levels.

Ozkan and Ozkan (2004) studied the determinants of cash holdings, in particular the role of ownership and control structure as determinants for cash holdings. Based on a sample of UK firms for the period of 1984 to 1999, Ozkan and Ozkan (2004) conclude that there is a significant non-monotonic relationship between managerial ownership and cash levels. Fundamentally, as the managerial ownership increases until 24% the level of cash holdings decrease. Cash level start to increase when the managerial ownership increases up to 64%, falling at higher levels. In addition, they found that cash flow and growth opportunities have a positive association with cash, while leverage and bank debt have a negative association.

Ferreira and Vilela (2004) developed a study of the cash holdings' determinants for 12 Economic and Monetary Union countries, from 1987 until 2000. They conclude that cash holdings are negatively associated to leverage, size and the amount of liquid assets substitutes while having a positive association with the investment opportunity set and cash flows. Using as a proxy for investor protection both the quality of law enforcement and the character of legal rules, they also suggest that firms with superior investment protection hold more cash.

Using a sample of US manufacturing firms between 1971 and 2000, Almeida et al. (2004) introduced financial constraints in the model of corporate demand for liquidity. Accordingly, they found that firms facing financial constraints have a greater propensity to accumulate cash out of their cash flows. In contrast, unconstrained firms do not display any systematic pattern.

Guney et al. (2007) examined the cash holding behaviour of firms from France, Germany, Japan, UK and US, particularly the relation between cash holdings and leverage. Their sample includes 4069 firms between 1996 and 2000. They argue that leverage have a non-monotonic relation to cash. Hence, leverage has a negative association to cash holdings to the extent that leverage is connected to the ability of a firm to issue debt. However, since an increase in leverage represents a greater risk of financial distress, the relation becomes positive at high levels of leverage, which is supportive of the precautionary motive. They expand their study to the influence of country-specific characteristics, as the degree of shareholder protection, ownership concentration and creditor protection and find that strong investor protection and high ownership concentration leads firms to hold fewer amounts of cash.

Bates et al. (2009) investigated the evolution of cash holdings in the US from 1980 to 2006. They find that the increase in cash holdings in the last years is attributable to the precautionary motive rather than agency explanations. They state that the increase in the level of cash over the period is mostly explained by changes in firm characteristics, such as the decrease in non-cash working capital, the decrease in Capital Expenditures and the increase both in cash flow volatility and in R&D.

Al-Najjar and Yacine Belghitar (2011), based on a large sample of 400 UK non-financial firms from 1991 to 2008, explored the link between corporate cash holdings and dividend policy. Their empirical analysis reflects that cash holdings are affected by size, growth, leverage, working capital ratio, profitability, risk and dividends. However, when controlled for endogeneity the dividend policy does not affect cash holdings.

Later, Al Najjar (2013) decided to explore corporate cash holding on a group of emerging markets[1], in terms of the impact of firm characteristics and corporate governance issues. The author find that emerging markets share similar patterns to developed markets in terms of cash holdings determinants. Lastly, they find that and dividend payout and leverage are negatively related to cash balances while size is positively related.

Dennis and Mckeon (2017) tried to understand the reason behind the dramatic increase in cash holdings from a different perspective, the perspective of firms reporting losses. With a sample of US firms between 1970 and 2016, they document that the increase in cash holdings is not due to an increase in agency problems, tax motives or cash flow volatility but rather

[1] The group of countries are Brazil, Russia, India, and China.

on an additional precautionary demand. Cash holdings are negatively associated with leverage, capital expenditures, size and dividends, while is positively associated with cash flow volatility and growth opportunities.

In table 1 we report the summary of empirical findings on the relation between cash holdings and financial determinants:

Table 1: Summary of findings on cash holdings

Authors	Firm Size	Cash Flow	Investment Opportunities	Dividend payment	Leverage	Cash Flow Volatility	Capital Expenditures
Kim et al. (1998)	n.s.	-	+	n.a.	-	+	n.a.
Opler et al. (1999)	-	+	+	-	-	+	+
Dittmar et al. (2003)	-	+	+	n.a.	n.a.	n.a.	n.a.
Ozkan and Ozkan (2004)	n.s.	+	+	n.s.	-	n.s.	n.a.
Ferreira and Vilela (2004)	-	+	+	n.s.	-	-	n.a.
Guney et al. (2007)	n.s.	-	+	n.s.	+/-	n.s.	+
Bates et al. (2009)	+/-	+/-	+	+/-	-	+	+/-
Al-Najjar and Belghitar (2011)	-	n.s.	+	-	-	n.a.	n.a.
Al Najjar (2013)	+	n.a.	n.a.	-	-	n.a.	n.a.
Dennis and McKeon (2017)	-	+/-	+	-	-	+	-

Table 1 shows the relationships between cash holdings and the transaction and precautionary motive determinants. The signal "+" indicates that the explanatory variable is significantly positively related with the dependent variable, while a "-" indicates a negative relationship. The "n.s." indicates that the authors do not find a significant relationship between the respective variables and the dependent variable. Situation when the authors did not test the variables are denoted with "n.a.".

2.5. Losses and Cash Holdings

Over the last years, several studies have identified an increase in firms reporting losses. The relation between this trend and several financial decisions represents an important challenge and has been topic of study by several authors. Joos and Plesko (2004) show that the percentage of firms reporting losses in S&P Compustat increase from 15% in the 1970's to roughly 35% in the 1990's. Denis and McKeon (2017) in their study also found a decreasing trend in the evolution of the profitability among US firm. In 1950, about 2% of public firms listed in Compustat reported operating losses[2] and the percentage registered a huge increase to over 30% in more recent years. The operating losses have not only become more persistent over time, as documented by Joos and Plesko (2004), but also the magnitude of these losses has grown considerably (Denis and McKeon, 2017). However, listed firms reporting losses is not a particular event among US firms. Jiang et al. (2016) documented an equal tendency also occurring in UK firms.

This increase frequency of firms reporting losses is not just a consequence of a rising in R&D expenditures since similar patterns occur even when measuring operating cash flows without considering R&D (Denis and McKeon, 2017). Moreover, Denis and McKeon (2017) evidence an increase in the volatility of cash flows, which Bates et al. (2009) connect to the constant increase in average corporate cash holdings.

Consistent with Fama and French (2004)[3], Klein and Marquardt (2006) found that smaller firms generally are the ones who report lower earnings and are more likely to report losses. This is due to economic factors intrinsic to this segment of firms: they are less diversified, have more idiosyncratic risk and undertake riskier projects (Klein and Marquardt, 2006).

Denis and McKeon (2017) show that firms reporting negative operating cash flows behave differently in several dimensions of corporate financial decisions, including the cash policy. During the 45 years under analysis, firms with positive operating cash flows increased only 90% their average cash holdings in opposition to an increase of 580% of negative operating cash flow firms (Denis and McKeon, 2017). Bates et al. (2009) also report that negative cash flow firms represent more than half of the increase in average cash holdings of US firms.

[2] Operating losses are define as negative cash flow from operations.
[3] Fama and French (2004) documented that the profitability and growth of listed firms after 1979 are due to small firms.

2.6. National Culture

A growing body of recent literature has been suggesting that there is a particular country-specific factor that should be consider when one study the economic phenomena, which is the effect of the cultural environment. Li et al. (2013) documented that the national cultural affects managers' views and preferences, even in a highly globalized world with sophisticated managers. Therefore, national culture matters in corporate decisions. The impact of national cultural on cash holdings was first study by Chang and Noorbakhsh (2009) and then by Chen et al. (2015). Both authors based their study on the assumption that, despite the various forms of governance structures and different stages of financial developments, cash holdings cannot be effectively studied without considering the diverse cultural inheritances.

Conducting a study for firms in more than 40 different countries, they apply the framework by Hofstede[4] (1980, 2001). Six dimensions compose the framework, where each one captures a cultural characteristic. The dimensions are: Individualism, Power Distance, Uncertainty-Avoidance, Masculinity and Long-Term Orientation and Indulgence.

In countries characterized by high levels of masculinity, managers tend to pursue their personal success, which involves taking risks and usually valueless investment opportunities. Thus, they accumulate large amounts of cash so they do not have to submit themselves to an outside scrutiny that they would need to have access to external funds (Chang and Noorbakhsh, 2009). Chang and Noorbakhsh (2009) found that the cultural dimension long-term orientation also influences the level of cash holdings. Long-Term oriented countries put emphasis on savings and tend to be conservative, while short-term oriented countries tend to be more aggressive in terms of spending. Therefore, Chang and Noorbakhsh (2009) show evidence that countries with long-term orientation tend to hold excessive cash balances. The last dimension of the study of Chang and Noorbakhsh (2009) was uncertainty-avoidance. Managers in uncertainty avoidance cultures tend to avoid uncertainty, mainly related to future cash flows. On the other hand, in low uncertainty avoidance cultures managers easily accept changes and are more will to take risks[5]. Their findings, later reinforced by Chen et al. (2015), was that firms in countries that do not tolerate uncertainty

[4] Hofstede's defined culture as "the collective programming of the mind which distinguishes members of one human group from another".
[5] Although uncertainty avoidance is not the same as risk aversion (Hofstede, 1980), Li et al. (2013) evidence a negative association between uncertainty avoidance and corporate risk taking.

are more likely to have larger cash reserves. In addition, Chen et al. (2015) find a relevant negative association between individualism and cash holdings[6]. Managers in individualistic cultures tend to be overly confidence and often displaying the self-attribution bias[7]. Hence, these managers usually underestimate the need for cash (Chen et al. 2015). These authors also find that individualism and uncertainty avoidance influence the precautionary motive for holding cash.

[6] Consistent with Li et al. (2013), who found a positive association between individualism and corporate risk taking.

[7] People's tendency to ascribe any personal success to their own talent, while blaming failure in bad luck (Hastorf, Scheneider and Polefka, 1970).

3. Hypothesis Development

Based on the motives and empirical evidence of the previous studies, this section introduces the research hypotheses. These hypotheses are a result of two research questions, based on the findings of Dennis and McKeon (2017), stating that firms' cash policy varies according to their cash flows. Thus, negative operating firms tend to hold more cash than firms reporting operating profits (Dennis and McKeon, 2017). To our knowledge, this is the only study that analyzes the relation between negative cash flows and cash holdings, although it only includes US firms in the sample. Therefore, the first part attempt to test whether this is a particular phenomenon for US firms and study which motive can be linked to the cash policy behavior of firms reporting losses. However, only two main motives are considered for firms to hoard cash: the precautionary and the transaction motive. The other two documented motives are not considered in this model. The second part includes the study of the interaction between national culture and cash holdings of firms reporting losses, attempting to test the impact in firms reporting losses.

i) Precautionary Motive

The precautionary motive predicts that firms hold more cash to prevent from future cash flow shocks. In this regard, when firms are currently facing operating losses they increase the probability of financial distress due to the incapacity to solve financial obligations or the incapacity to engage in value investment projects (Guney et al., 2007). Therefore, the demand for cash can increase due to the documented increase in firms reporting losses or due to the increase in the persistence of these losses (Dennis and McKeon, 2017). This means that the level of cash can increase due the expected level of future cash flows rather than the volatility of them. Therefore, we hypothesize:

Hypothesis 1 (H1): Consistent with the precautionary motive, we expect a negative relation between operating cash flows and the level of cash.

ii) Transaction Motive

The transaction motive assumes that firms should have cash to support its operations, avoiding the costs of accessing the external markets (Keynes, 1936). Kim et al. (1998) state that cash flows are a substitute for cash, exhibiting a negative relation. Essentially, we expect

firms to hold more cash when the financial variable cash flow is negative. Indeed, firms can become financially constrained[8] if operational losses become persistent. The hypothesis is:

Hypothesis 2 (H2): Consistent with the transaction motive, we expect a negative relation between operating cash flows and the level of cash.

The second research question aims to understand the influence of the national culture in the level of cash hoard by firms. As stated in the literature there are four dimensions already studied that impact on the cash level: Uncertainty-Avoidance, Individualism, Masculinity and Long-Term Orientation. Although Chen et al. (2015) show that only uncertainty-avoidance and individualism influences the precautionary motive to hold cash, this study will include the four dimensions. In addition, this study will also analyze the interaction effects between these cultural dimensions and firm risk characteristics.

iii) Individualism vs. Collectivism

According to Hofstede (1980, 2001), individualist countries put emphasis on themselves and their immediate families, searching their personal achievements. In opposite, in collectivist societies people see themselves and others as a part of a group. In this line, Chui and Kwok (2008) find an interesting relation between this cultural dimension and life insurance consumption. People in individualist countries rely on market-based life insurances, instead relying on others. Indeed, according to Chui and Kwok (2008), in individualist cultures, people see the dependence as a weakness. Unlike this, in collectivist societies people have the dependence on other, expecting their support if a person dies early.

Moreover, the dimension individualism is strictly connected to overconfidence (Chen et al., 2015) and to corporate risk-taking (Li et al., 2013). Shao et al. (2010) support this view, showing that in individualist countries firms tend to invest more in long term risky-assets, invest more in R&D and prefer to use excess cash to increase R&D rather than to pay dividends. Current literature shows that countries displaying greater levels of individualism tend to take more risks. In addition, Chen et al. (2015) find that firms in countries with low individualism are likely to hold more precautionary cash. Therefore, we hypothesize:

[8] The need to sell assets to face persistent losses can decrease the firm size. According to the transaction motive, Opler et al.(1999) evidence a negative relation between size and cash holdings.

Hypothesis 3 (H3): There is a negative association between individualism and cash holdings.

Hypothesis 3.1 (H3.1): Firms reporting losses in individualistic countries hold less cash.

iv) Masculinity vs Feminity

Hofstede (1980, 2001) defines the masculinity dimension, in a business context, as the score which measures the degree of cultural toughness versus tenderness. Managers in masculine societies are performance driven individuals given that organizations are more focused on results. These societies tend to reward individuals based on their performance rather than on equality (Chang and Noorbakhsh, 2009). When faced with investment opportunities, they tend to examine the facts individually and to base their decision on their personal judgment, having an "aggressive" attitude. They are willing to make risky decisions if they have a reward for a share of the decisions success. Therefore, to avoid being subject of an external evaluation, they tend to hold more cash to have freedom in their decisions. However, given their aggressive behavior[9] in the investment decision, they usually spend cash on risky and less valuable projects (Chang and Noorbakhsh, 2009). Cash holdings decisions in highly masculinity societies might be related to the agency costs theory (Chang and Noorbakhsh, 2009). Following the empirical literature, we hypothesize:

Hypothesis 4 (H4): There is a positive association between masculinity and cash holdings.

Hypothesis 4.1 (H4.1): Firms reporting losses in masculinity countries hold more cash.

v) Uncertainty Avoidance

Uncertainty Avoidance is one dimension of national culture (Hofstede 1980, 2001) that expresses the degree to which people feel comfortable to deal with uncertainty and ambiguity. In high uncertainty countries, people dislike the uncertainty and try to avoid changes, while low uncertainty societies easily accept changes and risk[10]. This cultural dimension was found as influencing the level of cash holdings (Chang and Noorbakshsh, 2009; Chen et al., 2015). In finance, the dimension reflects the tendency of managers to avoid the uncertainty and is negatively associated with corporate risk-taking (Li et al., 2013). In

[9] This aggressive behaviour comes from the persistent pursuit of competitive advantages and abnormal rates of return.

[10] Rieger et al. (2014) argues that "equalizing uncertainty avoidance with risk aversion is an oversimplification", since they find a relation between higher Uncertainty Avoidance and more risk seeking in losses.

addition, it impacts the precautionary motive to hold cash, as high uncertainty avoidance cultures tend to hold more precautionary cash (Chen et al.,2015). Under the precautionary motive, it is expected that in more uncertainty avoidance countries firms tend to have higher levels of cash, to prevent unexpected situations. Based on this evidence, the fourth hypothesis is:

Hypothesis 5 (H5): There is a positive association between uncertainty avoidance and cash holdings.

Hypothesis 5.1 (H5.1): Firms reporting losses in uncertainty avoidance countries hold more cash.

vi) Long Term Orientation vs Short Term Normative Orientation

In long-term oriented societies managers highlight patience, persistence, perseverance and savings. These societies prefer to maintain honored traditions and norms (Hofstede, 1980, 2001). Indeed, the humiliation in cases of failure (e.g. bankruptcy) force managers to avoid risky opportunities with short-term perspectives that might not be successful in the long-run. Ferris et al.(2013)[11] document that CEOs exhibit overconfidence in countries with a short-term orientation, as well in more individualistic countries. Chang and Noorbakhsh (2009) found that this cultural dimension presented by Hofstede (1980, 2001) has an impact on cash holdings. Investment opportunities in countries that are more long-term oriented are evaluated based on their capacity to generate future sustainable value on the long-term rather than in the short-term. Therefore, long-term orientation societies prefer safer investments, while short-term oriented cultures are more aggressive and encourage spending (Chang and Noorbakhsh, 2009). According to these findings the hypothesis is:

Hypothesis 6 (H6): There is a positive association between long-term orientation and cash holdings.

Hypothesis 6.1 (H6.1): Firms reporting losses in long-term oriented countries hold more cash.

[11] Ferris et al. (2013) studied the role of CEO overconfidence in M&A activity.

vii) Financial Constraints

The essence of financial constraints is the firm's ability to access external funding. Usually, constrained are defined as younger, smaller and firms that faces higher resistance when accessing external funds (Almeida et al., 2004). The propensity that constrained firms have to invest depend more in the available cash funds rather than in the existence of positive net present value projects (Hubbard and Petersen, 1988). In this regard, Almeida et al. (2004) report that constrained firms have a positive cash flow sensitivity of cash, while unconstrained firms should not display a propensity to save cash out of cash inflows. In addition, Almeida et al. (2004) report that firms with negative net income are more likely to be financially constrained. Han and Qiu (2007) demonstrate that the impact of cash flow volatility on firms' cash holdings is dependent on its financial constraints. Indeed, these authors found that in response to an increase in the cash flow volatility, firms tend to increase their cash holdings. Therefore, in this study we explore if the link between financial constraints, cash flow volatility and the demand for liquidity is reinforced as an important determinant of cash policy of a firm reporting negative losses. Therefore, our hypothesis is:

Hypothesis 7 (H7): There is a positive association between cash flow volatility of financial constraints measures and cash holdings.

Hypothesis 7.1 (H7.1): Constrained firms with negative cash flows in individualistic countries hold more cash than unconstrained firms.

Hypothesis 7.2 (H7.2): The relation with cash of constrained firms with negative cash flows in masculinity countries comparing with unconstrained firms is ambiguous.

Hypothesis 7.3 (H7.3): Constrained firms with negative cash flows in uncertainty avoidance countries hold more cash than unconstrained firms.

Hypothesis 7.4 (H7.4): The relation with cash of constrained firms with negative cash flows in long-term oriented countries comparing with unconstrained firms is ambiguous.

4. Data and Methodology

In this study, we use as sample a panel data of firms collected from Thomson Worldscope database for 46 countries. The sample, over the period 1992-2016, includes survivor and non-survivor firms. Following standard practice, we exclude financial firms because these firms must meet statutory capital requirements and their business involves inventories of marketable securities that are included in cash. Utility firms were also excluded because in many countries their cash holdings are subject to regulatory supervision. Regarding the national culture factors, the dimensions were gathered through a database provided by Hofstede[12]. Observations from countries for which Hofstede's cultural dimensions were not available were removed. All the main variables are winsorized at the 1st and 99th percentiles.

4.1. Dependent Variable

This research intends to study cash holdings, thus we use cash ratio as a way to measure it. The literature presents several ways to measure the cash ratio, such as cash and cash equivalents deflated by total assets (Kim et al., 1998; Ozkan and Ozkan, 2004; Bates et al., 2009; Dudley and Zhang, 2016; Dennis and McKeon, 2017). Opler et al. (1999) and Ferreira and Vilela (2004) use another approach, which is to consider the cash ratio as the ratio of cash divided to net assets. Foley et al. (2007), Bates et al. (2009) and Dudley and Zhang (2016) provide more ways to measure the cash ratio, as the logarithm of cash to net assets, the logarithm of cash to total assets and cash divided by sales. In this research, we follow the authors that measure the dependent variable as the cash and cash equivalents divided by total assets.

4.2. Independent Variables

Consistent with the existing literature, several variables describing the two motives (precautionary and transaction) to hold cash are used in our research. In addition, variables related to Hofstede's cultural dimensions for the period are included. One problem that usually is highlighted to these dimensions is related to the time lapse of the study.

[12] The data for Hofstede's dimensions for each country was taken from http://geerthofstede.com/research-and-vsm/dimension-data-matrix/

Considering that the Hofstede's study was conducted in the 1980s, authors often argue that the dimensions have changed over the years, weakening the link with corporate cash holdings. However, in his book Culture's Consequences (2001) Hofstede shows that more than 200 external comparative studies have supported the original findings. To confirm the robustness of the results, one alternative measure for cultural dimensions will be applied, the Tang and Koveos' cultural indices[13] (2008).

Regarding variables that affect the precautionary and the transaction motive, we use the following:

i) Cash Flow (CFLOW)

Kim et al. (1998) defend that cash flow provides an internal source of liquidity to meet operating expenditures and liabilities. The literature is ambiguous regarding this variable. On the one hand some researchers (e.g. Opler et al., 1999; Ferreira and Vilela, 2004) suggest a positive relation, as firms with higher cash flows stockpile more cash. Opposite to this, the literature present evidence of a negative relationship between cash flow and cash holdings (Kim et al., 1998). According to the precautionary motive to hold cash, as cash flow can be seen as a substitute for cash, a negative relation is expected. In accordance with several authors, this variable is measured as the earnings after taxes plus depreciation divided by total assets (e.g. Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004; Bates et al., 2009).

ii) Industry Cash Flow Volatility (ICFVOL)

Bates et al. (2009) identify the increase in cash flow volatility as one of the main determinants of the historical increase in cash holdings. Firms facing higher levels of volatility on cash flows have difficulties to make an accurate prediction of the future cash flows. This increase in the uncertainty induces the possibility of a shortage of cash and increases the probability of financial distress. According to the precautionary motive in order to prevent this, firms should hold more cash. However, the literature also shows a negative relation as reported by Ferreira and Vilela (2004). Nonetheless, this means that the sign of this variable is ambiguous. In order to measure cash flow volatility, we use the standard deviation of industry cash flow computed based on the method of Opler et

[13] An update of Hofstede's scores based on both institutional traditions and economic conditions of a country.

al. (1999), later used by several other authors, such as Ferreira and Vilela (2004), Bates et al. (2017) and García-Teruel et al. (2018). Specifically, for each company in a given year, we calculate the standard deviation of the cash flow of the last 10 years of data. Each company must have at least 3 years of data. Therefore, for each year we take the average cash flow standard deviation for each two-digit SIC code, and use this industry average as the measure of cash-flow volatility.

iii) *Firm Size (FSIZE)*

Related to the precautionary motive, Opler et al. (2009) state that larger firms are more likely to be able to liquidate their non-core assets in order to obtain cash. Considering that these larger firms are also subject to fewer restrictions and more growth opportunities, its marginal bankruptcy cost is lower (Myers, 1977). Therefore, according to the precautionary motive to hold cash, firm size is negatively related to cash holdings. Based on the transaction model of Miller and Orr (1966), larger firms have economies of scale associated with transaction costs. This means that big firms tend to have lower costs of raising external capital than small firms. Hence, a negative relation is also predicted by the transaction motive. Accordingly, a negative relation is expected between firm size and cash holdings. Following the literature, we use as a proxy to firm size the natural logarithm of sales.

iv) Leverage (LEV)

According to the empirical evidence (e.g. Kim et al., 1998; Opler et al., 1999; Ferreira and Vilela, 2004; Bates et al., 2009) firms decrease their cash levels as the leverage increases. The bankruptcy risk of a firm is increasing along with the level of leverage, considering that it becomes more difficult to raise additional debt. Therefore, according to the precautionary motive firms should hold more cash to avoid the possibility of financial distress (Guney et al., 2007). On the other hand, high leverage ratios could indicate a good relationship with creditors, which represents lower costs of additional financing. Thereby, firms can borrow debt as a solution when facing cash shortages. Thus, under the precautionary motive cash holdings has a positive relation to leverage while is negatively related under the transaction motive. Indeed, some authors interpret this as a non-linear relation between leverage and cash holdings since evidence shows

that firms should hold more cash in response to higher levels of debt, while high levels of debt could indicate a good creditor spread, therefore requiring lower levels of cash.

Based on Guney et al. (2007) we expect a negative relation with the coefficient of leverage and a positive relation with the squared variable. According to the majority of authors (Kim et al., 1998; Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004; Bates et al., 2009; Dennis and McKeon, 2017) as proxy for leverage, the ratio of total debt (long-term debt plus short-term debt) to total assets will be used. In order to control for a non-linear relation a squared term will be added (Guney et al., 2007).

v) Investment Opportunities (INVOP)

Several studies (e.g. Kim et al., 1998; Opler et. al, 1999; Bates et al., 2009) provide evidence that investment opportunities positively affect cash holdings. Companies with better investment opportunities tend to hold more cash due to the higher costs of external finance (Opler et al., 1999). Therefore, they experience higher costs of cash shortage. Essentially, cash shortage in a firm combined with an increase in investment opportunities means that managers have to give up on profitable projects. Given this, a positive relationship is expected either under the precautionary motive or under the transaction motive. In order to measure the variable investment opportunities, the market-to-book ratio will be used as a proxy (Opler et al., 1999; Ozkan and Ozkan, 2004; Dennis and McKeon, 2017). The market-to-book ratio is computed as the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets.

vi) Capital Expenditures (CAPEX)

Capital Expenditures are usually used to acquire, maintain or upgrade the physical assets of a firm. Therefore, firms incur in capital expenditures to have future benefits (Bates et al., 2009). The relation between capital expenditures and cash holdings is ambiguous since it can be seen as a proxy for debt capacity, distress costs or for investment opportunities. Considering the former, since capital expenditures translate into more assets the debt capacity of a firm increases (Stulz, 2007). According to the precautionary motive, this would decrease the demand for cash from these firms. Further, Riddick and Whited (2009) show that a productivity shock that causes an increase in investment may

temporarily reduce the cash holdings of firms. On the other hand, as a proxy for financial distress costs and/or investment opportunities it would be positively related to cash holdings (Bates et al., 2009). Therefore, the expected relation between capital expenditures and cash holdings is ambiguous. Based on previous empirical studies (Bates et al., 2009; Dudley and Zhang, 2016) CAPEX is measured through the ratio of capital expenditures to book value of assets.

vii) Dividend Payments (DIV)

According to Bates et al. (2009), the payment of dividends issues a positive signal for the public, which denotes that these firms have greater access to the capital markets. In addition, they tend to be less risky (Opler et al., 1999; Ferreira and Vilela, 2004). As result, the precautionary motive predicts a negative relationship between the amount of cash and the payment of dividends. On the side of the transaction motive, Bates et al. (2009) state that dividend-paying firms, when facing a shortage of cash, are able to raise funds at a lower cost by reducing their dividends payment. This means that the transaction motive also predicts a negative relation. Hence, a dividend dummy variable will be included to distinguish whether firms pays dividends. It will be assigned a value of "0" if the firm does not pay dividends in a given year and "1" otherwise (Ferreira and Vilela, 2004; Dennis and McKeon, 2017).

viii) R&D Intensity (RDI)

R&D intensity can influence cash holdings through two dimensions. First, a slowdown in the program of R&D has negative consequences for the firm due to its costs (Brown and Peterson, 2011). Second, as Dennis and McKeon (2017) documented, many firms with high R&D intensity also report negative cash flows[14]. R&D is a cash expense that firms reporting losses needs to cover. However, given the lower asset tangibility, R&D investments have a higher financing cost using external capital than capital expenditures. Therefore, according to the precautionary motive firms with higher R&D intensity should hold more cash to create a buffer against future shocks of cash flows. Following Dennis and McKeon (2017) this dummy variable takes the value of "1" when Research

[14] Firms with higher levels of R&D that report negative cash flows needs to cover this investment, usually through cash holdings.

and Development Expenses divided by the Total Assets is higher than 0.02. Otherwise, the dummy variable assumes a value of "0".

ix) Negative Cash Flows (CFNEG)

Finally, a negative cash flow dummy is also included in order to control for firms reporting losses. This dummy variable assumes a value of "1" when firms have negative operating cash flows, and a value of "0" otherwise (Dennis and McKeon, 2017).

Considering the cultural variables, we use four dimensions[15] to test the influence on firms reporting losses. Evidence proves that these dimensions influence corporate cash holdings (Chang and Noorbakhsh, 2009; Chen et al., 2015). Therefore, in order to test the above hypothesis, we use from Hofstede's study the following cultural dimensions: *Individualism* (IDV), *Masculinity* (MAS), *Uncertainty Avoidance* (UAI) and *Long-Term Orientation* (LTO).

4.3. Descriptive Statistics

In table 2 the descriptive statistics for each of the main variables used in our study are displayed.

Table 2: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std.Dev.	Observations
CASH	0.1580	0.1067	0.7755	0.0010	0.1605	335,355
CASH_2	0.3298	0.2332	2.0943	0.0024	0.3464	335,355
CFLOW	0.0441	0.0645	0.3122	-0.7845	0.1475	335,355
CFMAGN	-0.0309	0.0000	0.0000	-0.7845	0.1133	335,355
ICFVOL	0.0950	0.0635	0.5015	0.0143	0.0899	335,355
FSIZE	12.3087	12.2031	17.2940	8.0107	1.8941	335,355
FSIZE_2	12.0605	12.0811	17.0769	5.3132	2.1341	335,355
LEV	0.2190	0.1957	0.7089	0.0000	0.1823	335,355
LEV^2	0.0812	0.0383	0.5025	0.0000	0.1066	335,355
INVOP	1.5128	1.1511	7.4812	0.4513	1.1239	335,355
CAPEX	0.0912	0.0726	0.4104	0.0022	0.0751	335,355
I(DIV)	0.6122	1.0000	1.0000	0.0000	0.4872	335,355

[15] These dimensions range from 0 to 100, with higher scores meaning a greater influence of a specific dimension in a certain country. Considering the difference in scale among Hofstede's dimensions and financial variables, we scaled cultural variables by 100.

I(RDI)	0.1904	0.0000	1.0000	0.0000	0.3926	335,355
IDV	0.5636	0.4800	0.9100	0.1200	0.2806	335,355
MAS	0.6119	0.6200	0.9500	0.0500	0.1956	335,355
UAI	0.5877	0.4800	1.1200	0.0800	0.2370	335,355
LTO	0.5733	0.5113	1.0000	0.1310	0.2674	335,355

Table 2 reports descriptive statistics for the sample over the period 1992 to 2016. The dependent variable is CASH, computed as cash and cash equivalents over total assets. CASH_2 is measured as the ratio of cash and cash equivalents over net assets, where net assets is the difference between total assets and cash and cash equivalents. CFLOW is the ratio pre-tax profits plus depreciation over total assets. CFMAGN is the interaction of an indicator of negative cash flow dummy with cash flow. ICFVOL is the cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous five years. FSIZE is the natural logarithm of sales. FSIZE_2 is the natural logarithm of total assets. LEV is the ratio of total debt to total assets. LEV^2 is the squared term of leverage. INVOP is the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets. CAPEX is the ratio of capital expenditures to the book value of assets I(DIV) is a dummy variable that takes the value of one if the firm pays dividends and is set to zero otherwise. I(RDI) is a dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise. IDV is Hofstede's individualism index. MAS is Hofstede's masculinity index. UAI is Hofstede's uncertainty-avoidance index. LTO is Hofstede's long-term orientation index.

Concerning the dependent variable Cash Ratio, the average value says that our sample firms hold on average about 15.80% of their assets in cash. The literature presents some results that differ from ours, such as the values reported by Ozkan and Ozkan (2004) for UK listed firms (9.9%) and the cash ratio of 8.1% for US public firms reported by Ditmar et al. (2003). However these differences occur due to the international scope of these studies. Actually, considering studies for several countries our results are consistent, as for example the case of Chang and Noorbakhsh (2009) who reported an average value of 15.26%. Moreover, the results are slightly different when comparing an alternative measure, the ratio of cash to net assets. Considering this measure, our results show that firms hold an average cash ratio of 32.98% of total net assets (table B.4), which is quite different from the results of Opler et al. (1999), Ferreira and Vilela (2004), Chang and Noorbakhsh (2009) and Chen et al. (2015). For example, Opler et al. (1999) found a mean value of 17% for US firms, while Chang and Noorbakhsh found a mean of 15% for an international sample. This difference in results is explained by the different data sample periods of each study. As an example, Chang and Noorbakhsh (2009) data is from 1995 to 2004, while the data period in Ozkan and Ozkan (2004) ranges from 1984 to 1999.

Nonetheless, the average cash ratio changes according to the sign of the cash flow. As it possible to see in table 3, firms in the first decile of cash flow hold 18.25% of their assets in cash, while firms between the third and tenth decile only hold 16.53%. Indeed, according to our results, we found that cash is higher in the first cash flow decile and in the ninth and tenth decile, represennting 18.98% and 23.28% respectively.

Table 3: Average cash holdings by cash flow decile

The table report the evolution of average cash holdings by cash flow deciles for the sample of 335,355 firm-year observations, from 1992 to 2016. Values are an average over firm-year observations within each decile.

	Cash Flow decile			
Year	**1**	**2**	**3-10**	**Total**
1992	0.1320	0.1051	0.1272	0.1257
1993	0.1928	0.1215	0.1357	0.1370
1994	0.2281	0.1388	0.1309	0.1355
1995	0.2219	0.1406	0.1283	0.1329
1996	0.2672	0.1270	0.1256	0.1337
1997	0.2570	0.1289	0.1250	0.1350
1998	0.2354	0.1197	0.1241	0.1339
1999	0.2247	0.1204	0.1250	0.1339
2000	0.2362	0.1268	0.1280	0.1396
2001	0.2404	0.1261	0.1254	0.1412
2002	0.2576	0.1425	0.1336	0.1531
2003	0.2668	0.1476	0.1444	0.1605
2004	0.2819	0.1583	0.1519	0.1663
2005	0.2868	0.1530	0.1513	0.1662
2006	0.2888	0.1597	0.1512	0.1670
2007	0.2918	0.1635	0.1513	0.1682
2008	0.2376	0.1452	0.1423	0.1563
2009	0.2404	0.1486	0.1581	0.1686
2010	0.2650	0.1561	0.1613	0.1721
2011	0.2611	0.1541	0.1589	0.1698
2012	0.2268	0.1437	0.1608	0.1657
2013	0.1890	0.1399	0.1633	0.1631
2014	0.1837	0.1356	0.1628	0.1615
2015	0.1805	0.1347	0.1681	0.1655
2016	0.1825	0.1454	0.1653	0.1645

Being positive cash flow an inflow of funds, it is clear to understand the relation between cash and cash flow in the last two deciles. Nonetheless, having more cash in the lowest decile could represent a precaution against the unpredictable future cash flows. According to the

table 4, cash holdings from firms reporting losses increased by roughly 39% from 1992 to 2016, while firms with positive cash flows increased around 30%.

Table 4: Average cash holdings by the sign of cash flow

The table report the evolution of average cash holdings by the sign of cash flow for the sample of 335,355 firm-year observations, from 1992 to 2016. Values are an average over firm-year observations within each decile.

	Cash Flow	
Year	**Neg. Cash Flow**	**Pos. Cash Flow**
1992	0.1153	0.1272
1993	0.1451	0.1357
1994	0.1670	0.1309
1995	0.1648	0.1283
1996	0.1861	0.1256
1997	0.1886	0.1250
1998	0.1736	0.1241
1999	0.1692	0.1250
2000	0.1823	0.1280
2001	0.1865	0.1254
2002	0.2053	0.1336
2003	0.2125	0.1444
2004	0.2276	0.1519
2005	0.2290	0.1513
2006	0.2318	0.1512
2007	0.2370	0.1513
2008	0.1979	0.1423
2009	0.1965	0.1581
2010	0.2138	0.1613
2011	0.2109	0.1589
2012	0.1843	0.1608
2013	0.1621	0.1633
2014	0.1543	0.1628
2015	0.1536	0.1681
2016	0.1602	0.165
Average Increase	38.98%	29.90%

Looking at the explanatory variable, cash flow shows an average value of 0.044, which is below the value of Ozkan and Ozkan (2004) and Ferreira and Vilela (2004), Chang and Noorbakhsh (2009) and Chen et al. (2015) . Regarding this, the analysis of the mean values of cash flows during our sample period (Table 5) shows that the magnitude of negative cash flows (decile 1 and 2) become, on average, higher between 2012 and 2016 when compared with the first period (1992-1996).

Table 5: Cash Flow by decile

The table report the evolution of average cash flows by deciles formed annually. The sample is 335,355 firm-year observations, from 1992 to 2016. Values are an average over firm-year observations within each decile.

Cash Flow decile	1992-1996	1997-2001	2002-2006	2007-2011	2012-2016
1	-0.2356	-0.3008	-0.3130	-0.3007	-0.2467
2	-0.0114	-0.0161	-0.0181	-0.0187	-0.0167
3	0.0229	0.0233	0.0237	0.0236	0.0240
4	0.0418	0.0418	0.0418	0.0419	0.0418
5	0.0571	0.0571	0.0571	0.0571	0.0570
6	0.0724	0.0723	0.0723	0.0723	0.0721
7	0.0892	0.0891	0.0890	0.0890	0.0889
8	0.1095	0.1095	0.1094	0.1095	0.1093
9	0.1391	0.1391	0.1389	0.1391	0.1387
10	0.2051	0.2137	0.2173	0.2183	0.2160

Actually, during this period also the average cash flow decrease from 0.71 to 0.52 for all the sample firms. It is also interesting to notice that the magnitude of negative cash flows sustains the biggest values from 2002 until 2011, which the period usually denoted as pre-crisis and the crisis peak period. The explanatory variable size, measured as the logarithm of sales, reports a mean value of 12.06. This mean is almost equal to the firm size mean value measured as the logarithm of total asset (12.31%). For this variable, Ozkan and Ozkan (2004) reported a value of 10.87 for its UK sample firms, which is close to our results. In opposite, Opler et al. (1999) got a mean of 4.59. This difference can be justified by the increase in firm size over the last years. The average value of the variable leverage is 0.22, while the squared term has a mean of 0.08. Actually, this value is in line with several authors (e.g. Opler et al., 1999; Ferreira and Vilela, 2004; Bates et al., 2009) which reports values around 0.20 and 0.25. Then, the variable investment opportunity has a mean value of 1.51. Once again, this value is in line with the majority of previous results (Opler et al., 1999; Ozkan and Ozkan, 2004; Ferreira and Vilela, 2004). Regarding the variable Capital Expenditures, we got a mean value of 0.09.

Finally, the national culture dimensions, which are steady during the period under analysis, are in the range of 5 to 112, being uncertainty-avoidance the variable with greater amplitude. The median value of individualism is 56 for our sample, the highest value of 91 belongs to U.S.A. while the lowest value of 12 belongs to Venezuela. Mean Masculinity is 61. Masculinity values ranges from 95 (Japan) to Sweden (5). For uncertainty avoidance the median is 59, with the highest value of 112 reported by Greece, while the lowest of 8 is from Singapore.

The long-term orientation dimension score a mean of 57. The highest score (100) is from South Korea and the lowest score (13) is from Colombia.

4.4. Methodology

Panel data is a type of dataset that contains both cross-sectional and time series dimension. This combination of data allows the incorporation in the study of several units explained over a period of time, rather than in a single moment. Therefore, it is a more informative data, with more variability and less collinearity among variables, allowing control for individual heterogeneity (Baltagi, 2008).

Commonly when dealing with panel data authors use the Pooled OLS regression, such as the case of Ferreira and Vilela (2004) and Bates et al. (2009). Pooled OLS ignores the panel structure of the data and simply estimate a pooled regression for all firms in the sample. Preserving the variation in the data comes at the cost of potentially biased coefficients. In this regard, we could have external factors that exert influence on cash holdings that cannot be observed or even measured (Wooldridge, 2015). These alone would not pose a problem because these factors are reflected on the error term, however if these unobserved factors are correlated with both the dependent and the independent variables the estimators will become biased and inconsistent. Indeed, Peterson (2009) shows that in the presence of time effects and/or fixed effect the pooled OLS regression is biased.

The most used panel data methods that take into account these unobserved factors are the fixed-effect model and the random-effect model, which are distinguishable based on the relation between the firm-specific unobserved factors and the explanatory variable (Kim et al., 1998; Opler et al., 1999; Ozkan and Ozkan, 2004; Harford et al., 2008; Bates et al., 2009). The fixed-effect model control for the effects of time-invariant variables, while the random-effect model assumes that the unobserved variables are uncorrelated with all the observed variables. The fixed-effect model assumes that the time-invariant characteristics should not be correlated with other individual characteristics. In this model the unobserved firm-specific effects are removed, taking into account the firm-specific unobserved fixed effects. However, also the explanatory variables that are constant over time are excluded. Therefore, this model becomes inappropriate when the key explanatory variable is time-invariant. Unlike the fixed-effects model, the random-effect model includes the time-variant variables,

assuming that the variation across entities is random and uncorrelated with the independent variables.

Another way used in finance by researchers to address both firm and time effects is to apply year dummies for each period and then cluster by firm, considering that we have more firms than years in the sample. However, if the time effect is not fixed, the time dummies will not be capable to remove completely the dependence (Peterson, 2009). Peterson (2009) also argue that even standard errors clustered by firm can be biased. Consequently, when there are enough clusters in each dimension the author defend that double clustering produces unbiased standard errors and correctly sized confidence intervals. In line with this, Gow et al. (2010) provide evidence that cluster by both firm and time produces well-specified test statistics in all the form of dependence tested (cross-sectional and time-series dependence).

Based on Peterson (2009)[16], we find in untabulated results that our data suffer from firm effect and time effect. Considering these findings, we will address the double-clustered model in our econometric model.

In order to get an empirical view on the research questions, two empirical models are present below. Thus, the first one (4.3.1) will include standard variables affecting both the precautionary and transaction motive to hold cash. To capture the effect of losses on firms' cash policy we add an indicator of negative operating cash flows. In addition, an interaction term between this variable and cash flows is added to capture the magnitude of the losses (Dennis and McKeon, 2017). According to Denis and McKeon (2017) this term is an option to deal with the convexity in the relation between cash holdings and cash flow, allowing to make interpretations of the different effects of negative and positive cash flow firms. Lastly, since we predict a nonlinearity in the association between leverage and cash holdings, one squared term is added to the regression:

[16] Peterson (2009) prove the presence of firm effect in the data if the standard errors clustered by firm are three to four times larger than the White standard errors. When the White Standard errors are two to three times larger than the standard errors clustered by time, the data suffer from time effect (Peterson, 2009). In addition, if the standard errors clustered by firm and time are larger than the standard errors clustered by just one dimension, there is both time and firm effect (Peterson, 2009).

$$CASH_{i,t} = c + \beta_1 CFLOW_{i,t} + \beta_2 (CFNEG \times CFLOW)_{i,t} + \beta_3 CFNEG_{i,t} + \beta_4 ICFVOL_{i,t} + \beta_5 FSIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 LEV^2{}_{i,t} + \beta_8 INVOP_{i,t} + \beta_9 CAPEX_{i,t} + \beta_{10} DIV_{i,t} + \beta_{11} RDI_{i,t} + \mu_{i,t} \quad (4.3.1)$$

In addition to the standard variables affecting both the precautionary and transaction motive to hold cash, the second model (4.3.2) will use the cultural dimensions as presented by Hofstede (1980, 2001):

$$CASH_{i,t} = c + \beta_1 CFLOW_{i,t} + \beta_2 (CFNEG \times CFLOW)_{i,t} + \beta_3 CFNEG_{i,t} + \beta_4 ICFVOL_{i,t} + \beta_5 FSIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 LEV^2{}_{i,t} + \beta_8 INVOP_{i,t} + \beta_9 CAPEX_{i,t} + \beta_{10} DIV_{i,t} + \beta_{11} RDI_{i,t} + \beta_{12} IDV_{i,t} + \beta_{13} MAS_{i,t} + \beta_{14} UAI_{i,t} + \beta_{15} LTO_{i,t} + \mu_{i,t} \quad (4.3.2)$$

Moreover, in order to test the impact of negative cash flows on cultural variables, we introduce an interaction term between each Hofstede's dimension (1980, 2001) and the variable Cash Flow Magnitude.

$$CASH_{i,t} = c + \beta_1 CFLOW_{i,t} + \beta_2 (CFNEG \times CFLOW)_{i,t} + \beta_3 CFNEG_{i,t} + \beta_4 ICFVOL_{i,t} + \beta_5 FSIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 LEV^2{}_{i,t} + \beta_8 INVOP_{i,t} + \beta_9 CAPEX_{i,t} + \beta_{10} DIV_{i,t} + \beta_{11} RDI_{i,t} + \beta_{12} IDV_{i,t} + \beta_{13} MAS_{i,t} + \beta_{14} UAI_{i,t} + \beta_{15} LTO_{i,t} + \beta_{16} (CFMAGN \times IDV)_{i,t} + \beta_{17} (CFMAGN \times MAS)_{i,t} + \beta_{18} (CFMAGN \times UAI)_{i,t} + \beta_{19} (CFMAGN \times LTO)_{i,t} + \mu_{i,t} \quad (4.3.3)$$

Where i stands for firm, t denotes specific year within the sample period and μ is the error term.

Concerning the regression, the double-clustered model is robust to heteroscedasticity. In table 6, we report Pearson correlation coefficient between the main explanatory variables. The correlations that we got are not significantly high, which means that there is no collinearity between two explanatory variables. To exclude the hypothesis of the presence of

collinearity we further perform the variance inflation factor (table B.3) among the main explanatory variables. Since the values are below 10 there are no concerning about corrective measures (Wooldridge, 2015).

Table 6: Pearson Correlation Coefficients

The table report the outputs of the Pearson correlation coefficients for our main variables. All the variables are significant at the 5% percent level.

	CASH	CFLOW	I(CFNEG)	ICFVOL	FSIZE	LEV	INVOP	CAPEX	I(DIV)	I(RDI)	IDV	MAS	UAI	LTO
CASH	1													
CFLOW	-0.1408	1												
I(CFNEG)	0.1311	-0.6917	1											
ICFVOL	0.2139	-0.2536	0.2696	1										
FSIZE	-0.2345	0.3741	-0.3792	-0.2906	1									
LEV	-0.4135	-0.0529	0.0330	-0.1807	0.2008	1								
INVOP	0.2990	-0.0259	0.0590	0.1801	-0.0918	-0.2002	1							
CAPEX	-0.1505	0.0672	-0.0144	0.1079	-0.0041	0.0871	0.0851	1						
I(DIV)	-0.0827	0.3285	-0.3792	-0.3203	0.3897	-0.0394	-0.0657	-0.0577	1					
I(RDI)	0.2547	-0.0886	0.0844	0.1295	-0.0143	-0.1777	0.2079	-0.0105	-0.1004	1				
IDV	0.0163	-0.0894	0.1006	0.3810	0.0197	-0.0842	0.1665	0.1590	-0.2246	0.1382	1			
MAS	0.0720	-0.0283	-0.0432	-0.1504	0.1517	-0.0203	-0.0557	-0.1239	0.1479	0.0473	0.0970	1		
UAI	-0.0071	0.0323	-0.0794	-0.3036	0.1596	0.0650	-0.1839	-0.1219	0.1675	0.0091	-0.2544	0.3927	1	
LTO	0.0369	0.0701	-0.1215	-0.4246	0.1347	0.0471	-0.1657	-0.1842	0.2932	-0.0097	-0.6767	0.2817	0.5099	1

4.4.1. Financial Constraints Criteria

Following Almeida et al. (2004), Kaplan and Zingales (1997), and Whited and Wu (2006), financial constraints influence the way firms manage their cash holdings. To explore the issue we implement several financial constraints proxies. The literature suggests a number of measures, however critics identifying a variety of problems with these approaches (see, for instance, Farre-Mensa and Ljungqvist., 2016)[17]. Considering that we do not have a study addressing these problems, we use from the literature (e.g. Almeida et al., 2004; Whited and Wu, 2006) four alternative measures to partition our sample:

i) **KZ Index**: Rather than using a model based on a single firm characteristic, the measure developed by Kaplan and Zingales (1997) is used. The KZ Index collectively determines the firm as constrained or unconstrained based on the profitability, growth opportunities, leverage ratio and cash holdings.

$$KZ\ Index = -1.002 \times CashFlow + 0.283 \times Tobin's\ Q + 3.139 \times Leverage - 39.368 \times Dividends - 1.315 \times Cash\ Holdings$$

Firms in the bottom (top) three deciles of the KZ Index are ranked as financially unconstrained (constrained). The ranking is performed in an annual basis.

ii) **WW Index**: Unlike the KZ Index, the Whited and Wu index (2006) uses firm characteristics factors associated with external finance constraints. The index is computed as follows:

$$WW\ Index = -0.091 \times CashFlow - 0.062\ Dividend\ Dummy + 0.021 Long - Term\ Debt - 0.044 \times Size + 0.102 \times Industry\ Sales\ Growth - 0.035 \times Sales\ Growth$$

[17] Farre-Mensa and Ljungqvist (2016) find that firms denoted as constrained are not constrained in their ability to access external funds. The "evidence suggests that extant findings that have been attributed to constraints may instead reflect differences in the growth and financing policies of firms that find themselves at different stages of their lifecycles." (Farre-Mensa and Ljungqvist, 2016)

Firms in the bottom (top) three deciles of the WW Index are classified as financially unconstrained (constrained). The ranking is performed in an annual basis.

iii) **Firm Size**: Based on the argument that smaller firms have more difficult to obtain external finance given that they are typically younger and smaller, we rank firms based on their size in an annual basis over the sample period (Almeida et al., 2004). Firms are assigned as constrained (unconstrained) if they are in the bottom (top) three deciles of the size distribution.

iv) **Dividend Payout Ratio**: According to Fazzari et al. (1998) we rank firms according to the dividend payout ratio. The literature states that unconstrained firms are likely to pay higher amount of dividends as compared to constrained firms (Almeida et al., 2004). Therefore we rank firms as constrained (unconstrained) if those firms are in the bottom (top) three deciles of the annual payout ratio. The payout ratio is computed as the ratio of total dividends to operating income.

5. Empirical Results

In this section, we present the results from the analysis. We divide the section in four subsections. Aiming to know which motive best explain the behavior of firms, the first subsection represents the basic empirical model for cash holdings. In the second subsection, we introduce the national culture dimensions in order to access the effect on the cash ratio. In addition, in subsection three we measure the impact of financial constraints in firms reporting losses. Lastly, we present our robustness checks for the equation (4.3.1.) and equation (4.3.2.).

5.1. Cash Holdings Empirical Model

The empirical analysis start with the debate whether the firm characteristics discussed in section 4 affect cash holdings, explaining which motive best explains the behavior of loss-making firms' in terms of cash policy. In table 7, we report results from double-clustered model for the full sample of 335,355 firm-year observations, distinguishing those reporting negative cash flows.

Table 7: Estimation Output of equation (4.3.1)

Independent Variables	(1)	(2)	(3)
Constant	0.2876***	0.2790***	0.2754***
	(0.0054)	(0.0052)	(0.0050)
$CFLOW_t$	-0.0819***	0.0657***	0.0659***
	(0.0071)	(0.0250)	(0.0233)
$CFMAGN_t$		-0.2003***	-0.1945***
		(0.0277)	(0.0270)
$I(CFNEG)_t$		0.0045**	
		(0.0021)	
$I(CFNEG)_{t-3}$			0.0278***
			(0.0048)
$ICFVOL_t$	0.1151***	0.1063***	0.0979***
	(0.0111)	(0.0117)	(0.0115)
$FSIZE_t$	-0.0058***	-0.0057***	-0.0053***
	(0.0005)	(0.0005)	(0.0005)
LEV_t	-0.7522***	-0.7358***	-0.7356***
	(0.0103)	(0.0103)	(0.0104)
LEV^2_t	0.8602***	0.8487***	0.8489***
	(0.0130)	(0.0130)	(0.0131)
$INVOP_t$	0.0252***	0.0223***	0.0219***
	(0.0016)	(0.0017)	(0.0016)
$CAPEX_t$	-0.2815***	-0.3210***	-0.3189***
	(0.0091)	(0.0096)	(0.0097)

$I(DIV)_t$	0.0081***	0.0067***	0.0073***
	(0.0019)	(0.0017)	(0.0018)
$I(RDI)_t$	0.0575***	0.0571***	0.0568***
	(0.0024)	(0.0024)	(0.0024)
R-squared	0.3286	0.3309	0.3320
F-Statistic	11793.08	11799.41	9771.89
Observations	335,355	335,355	335,355

Table 7 presents output estimation of the base empirical model (4.3.1.) Double-Clustered Model (column 1, 2 and 3).).The dependent variable is $CASH_t$, computed as cash and cash equivalents over total assets. $CFLOW_t$ is the ratio pre-tax profits plus depreciation over total assets. $CFMAGN_t$ is the interaction of an indicator of negative cash flow dummy with cash flow. $I(CFNEG)_t$ is a dummy variable set to one when cash flow is negative, and set to 0 otherwise. $I(CFNEG)_{t-3t}$ is a dummy variable set to one when cash flow is negative in the previous three years, and set to 0 otherwise. $ICFVOL_t$ is the cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous five years. $FSIZE_t$ is the natural logarithm of sales. LEV_t is the ratio of total total debt to total assets. LEV^2_t is the squared term of leverage. $INVOP_t$ is the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets. $CAPEX_t$ is the ratio of capital expenditures to the book value of assets. $I(DIV)_t$ is a dummy variable that takes the value of one if the firm pay dividends and is set to zero otherwise. $I(RDI)_t$ is a dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise. Robust standard errors to heteroscedasticity are reported in parenthesis under each coefficient. Statistically significance is represented by * at 10%, ** at 5% and *** at 1%.

The results support strong evidence of the effect of both transaction and precautionary motive on cash reserves for loss firms, confirming that the sign of the cash flow have an impact on firms' cash policy. Nonetheless, the precautionary motive has the power to best explain the behavior of firms reporting losses. The variables applied in the model are significant at one-percent level. An exception is the dummy variable of negative cash flows, which is significant at five-percent level (column 2).

The variable Size ($FSIZE_t$) has the expected relation predicted by the precautionary and transaction motive. The relation confirms that the size is negatively correlated with cash ratio, considering that these firms are able to easily access cash, through the sale of their non-core assets or even through economies of scale when recurring to the capital markets. (Opler et al., 1999; Ferreira and Vilela, 2004; Dennis and McKeon, 2017).

The cash flow variable is negative and significant in the column (1). However, when adding the indicator of negative values for cash flow and the interaction term to capture the magnitude of losses (column 2), the variable turns to positive. This shows that forcing the cash flow variable into a linear relation with cash holdings jeopardizes the model. This non-linear relation confirms findings of previous studies (e.g. Denis and McKeon, 2017), showing

that large positive cash flows are penalized in predictions of cash ratios. In sum, the relation between cash flow and cash holdings is dependent on the sign of cash flows.

The expected association between industry cash flow volatility ($ICFVOL_t$) and cash level is positive, reinforcing the notion that firms with higher levels of volatility have higher cash ratios due to the bigger exposure to cash flow shocks and liquidity risk (Acharya et al., 2014). Indeed, this is in accordance with the precautionary motive.

The variable leverage has effect on the risk of business, being a proxy for the capacity of firms to resort to the capital markets (credit spread) in case of need. We got results for both variables that are in accordance with the findings of Guney et al. (2007). Thus, our regression shows a negative association between cash holdings and leverage (LEV_t) and a positive relation between cash holdings and the squared term of leverage (LEV^2_t). This shows that for lower levels of leverage, firms have more ability to access external markets, while highly leverage firms have more cash due to a higher risk of financial distress (Guney et al, 2007).

The result that we got from the relation between investment opportunities ($INVOP_t$) and cash confirm previous findings of several researchers (e.g. Opler et al., 1999; Ferreira and Vilela, 2004; Bates et al. 2009) and supports the transaction and precautionary motive. This confirms the argument that firms should prevent a cash shortage to avoid loss valuable investment opportunities and the need to recur to external funds. An increase of 1 percent in the variable investment opportunities ($INVOP_t$) result in an increase by 0.0223 percent of the cash ratio.

Following the studies of Bates et al. (2009) and Denis and McKeon (2017) we also find a negative relationship between cash holdings and capital expenditures. This relation is supported by the precautionary motive as more assets translate in an increase of debt capacity, therefore decreasing the demand for cash (Bates et al., 2009). The dummy variable dividend is significant and has a negative association to cash, opposite to the relation found in previous studies (Pinkowitz and Williamson, 2001; Ferreira and Vilela, 2004; Bates et al., 2009). A possible justification to firms hold larger amounts of cash is that dividend payers try to avoid a dividend cut due to costly signaling to the market (Drobetz and Grüninger, 2007).

Lastly, the dummy variable R&D intensity has the predicted association with cash. This means that companies with higher R&D intensity should hold more cash in order to avoid

consequences of negative effects of shocks in cash flows (Dennis and McKeon, 2017). The following table 3 presents the estimation output of equation (4.3.1.).

In column (3) we present the results with the inclusion of an additional variable, namely representing the persistence of negative cash flows. The variable shows a positive relation and significant relation with the dependent variable cash ratio. In line with Dennis and Mckeon (2017), this might indicate that the persistence of negative cash flows creates an additional precautionary demand for cash.

5.2. Effect of National Culture

Concerning the analysis of the national culture, we re-run the equation including four Hofstede dimensions: Individualism, Masculinity, Uncertainty-Avoidance and Long-Term Orientation. The following table 8 presents the estimation outputs:

Table 8: Estimation output of equation (4.3.2.) and (4.3.3.)

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Constant	0.2011***	0.2593***	0.2010***	0.2601***
	(0.0080)	(0.0049)	(0.0079)	(0.0047)
$CFLOW_t$	0.1530***	0.1498***	0.1431***	0.1325***
	(0.0258)	(0.0237)	(0.0246)	(0.0229)
$CFMAGN_t$	-0.2932***	-0.1258***	-0.2829***	-0.2636***
	(0.0299)	(0.0357)	(0.0296)	(0.0273)
$I(CFNEG)_t$	0.0083***	0.0127***		
	(0.0019)	(0.0020)		
$I(CFNEG)_{t-3}$			0.0258***	-0.0269***
			(0.0049)	(0.0094)
$ICFVOL_t$	0.2124***	0.1875***	0.2049***	0.1774***
	(0.0088)	(0.0107)	(0.0088)	(0.0101)
$FSIZE_t$	-0.0054***	-0.0049***	-0.0051***	-0.0048***
	(0.0005)	(0.0004)	(0.0004)	(0.0004)
LEV_t	-0.7145***	-0.7155***	-0.7159***	-0.7167***
	(0.0104)	(0.0103)	(0.0105)	(0.0104)
LEV^2_t	0.8220***	0.8234***	0.8247***	0.8250***
	(0.0138)	(0.0139)	(0.0139)	(0.0139)
$INVOP_t$	0.0234***	0.0235***	0.0231***	0.0234***
	(0.0020)	(0.0018)	(0.0019)	(0.0017)
$CAPEX_t$	-0.2898***	-0.2901***	-0.2869***	-0.2856***
	(0.0099)	(0.0092)	(0.0099)	(0.0095)
$I(DIV)_t$	-0.0055***	-0.0048***	-0.0053***	-0.0046***
	(0.0013)	(0.0014)	(0.0013)	(0.0015)
$I(RDI)_t$	0.0531***	0.0546***	0.0529***	0.0548***
	(0.0024)	(0.0025)	(0.0024)	(0.0024)

IDV	-0.0235***		-0.0238***	
	(0.0038)		(0.0037)	
MAS	0.0526***		0.0520***	
	(0.0054)		(0.0054)	
UAI	0.0050		0.0042	
	(0.0059)		(0.0059)	
LTO	0.0634***		0.0631***	
	(0.0039)		(0.0039)	
IDV_M		-0.0396***		-0.0385***
		(0.0033)		(0.0032)
MAS_M		0.0096***		0.0101***
		(0.0017)		(0.0017)
UAI_M		0.0198***		0.0202***
		(0.0031)		(0.0030)
LTO_M		0.0046***		0.0030*
		(0.0016)		(0.0017)
IDV_M*CFMAGN$_t$		-0.1643***		0.0653***
		(0.0168)		(0.0064)
MAS_M*CFMAGN$_t$		-0.0474***		0.0164***
		(0.0135)		(0.0063)
UAI_M*CFMAGN$_t$		0.0003		-0.0044
		(0.0192)		(0.0075)
LTO_M*CFMAGN$_t$		0.0510***		-0.0108
		(0.0140)		(0.0079)
R-squared	0.3506	0.3530	0.3514	0.3527
F-Statistic	8262.53	6610.07	8268.68	6602.41
Observations	335,355	335,355	335,355	335,355

Table 8 presents output estimation of the empirical models (4.3.2.) and (4.3.3.) through Double Clustered Model. In column (1) we present the equation model (4.3.2.). In column (2) we introduce the dummy variable I(CFNEG)$_{t-3}$, which takes the value of 1 if the three previous firm's cash flow were negative, and zero otherwise. In column (3) we include four interaction terms between the variable CFMAGN$_t$ and the four hofstede's cultural dimensions. In column (4) we include four interaction terms between the variable CFMAGN$_t$ and the four hofstede's cultural dimensions for firms reporting persistent loses. The dependent variable is CASH$_t$, computed as cash and cash equivalents over total assets. CFLOW$_t$ is the ratio pre-tax profits plus depreciation over total assets. CFMAGN$_t$ is the interaction of an indicator of negative cash flow dummy with cash flow. I(CFNEG)$_t$ is a dummy variable set to one when cash flow is negative, and set to 0 otherwise. . I(CFNEG)$_{t-3t}$ is a dummy variable set to one when cash flow is negative in the previous three years, and set to 0 otherwise. ICFVOL$_t$ is the cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous five years. FSIZE$_t$ is the natural logarithm of sales. LEV$_t$ is the ratio of total total debt to total assets. LEV^2_t is the squared term of leverage. INVOP$_t$ is the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets. CAPEX$_t$ is the ratio of capital expenditures to the book value of assets. I(DIV)$_t$ is a dummy variable that takes the value of one if the firm pay dividends and is set to zero otherwise. I(RDI)$_t$ is a dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise. IDV is Hofstede's individualism index. IDV_M is Hofstede's individualism index that equals one for countries above the median, and zero otherwise. MAS is Hofstede's masculinity index. MAS_M is Hofstede's masculinity index that equals one for countries above the median, and zero otherwise. UAI is Hofstede's uncertainty-avoidance index. UAI_M is Hofstede's uncertainty-avoidance index that equals one for countries above the median, and zero otherwise. LTO is Hofstede's long-term orientation index. LTO_M is Hofstede's long-term orientation index that equals one for

countries above the median, and zero otherwise. Robust standard errors to heteroscedasticity are reported in parenthesis under each coefficient. Statistically significance is represented by * at 10%, ** at 5% and *** at 1%.

Starting from the column (1), the comparison between both equation's output shows that variables maintain equal statistical significance. Overall, with the inclusion of these cultural dimensions the coefficients' signs for the main financial determinants of cash balances are also not different. The only change is the sign of the dummy variable dividend, which becomes negative. This relation contradicts the previous model (Table 3), showing that firms do not consider the signaling hypothesis. Actually, a possible justification is that dividend paying firms can face a shortage of cash by cutting their dividend payments (Opler et. al, 1999; Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004). Indeed, this shows the ambiguous relation found in the literature about this variable.

Regarding the cultural indicators, the coefficient of Individualism is statistically significant at the one-percent level. The magnitude of the coefficient shows that a one-unit change in individualism reduces cash holdings by 0.0235 percent, which is in line with our third hypothesis. This result is in accordance with Chen et al. (2015), which suggest that in individualistic countries managers are overconfident about their firm's financial performance, therefore underestimating the need for cash. In similar way, in these countries managers tend to engage in more risky projects when they have excess cash (Chen et al., 2015).

Our fourth hypothesis is confirmed through the positive and statistically significant coefficient of masculinity. This means that firms in masculinity countries tend to hold larger cash ratios. This is due managers' willingness to avoid being subject to the market analysis when investing in projects. So, holding more cash allow them to pursuit their investment projects without outside scrutiny (Chang and Noorbakhsh, 2009).

We also find that the relation between cash holdings and uncertainty avoidance dimension is not statistically significant. However, the positive sign of the coefficient of Uncertainty Avoidance suggest that firms with more uncertainty avoidance tend to hold more cash. Our hypothesis defends that countries with higher levels of uncertainty avoidance tend to avoid the ambiguity and uncertainty about the future, hedging against future cash shortfalls through the accumulation of cash (Chen et al., 2015). Given that no statistical significance is found in the coefficient associated with, our hypothesis is not supported.

Lastly, the positive and statistically significant coefficient of long-term orientation lend support to our sixth hypothesis. This is in accordance with prior evidences that documents a positive relation between cash ratios and long-term orientation (Chang and Noorbakhsh, 2009). The main features of long-term societies (e.g. patience, perseverance and willingness to safety) explains the managerial propensity to invest more in cash. Therefore, our results provide evidence that long-term societies prefer safer and long-term investments (Chang and Noorbakhsh, 2009).

We also study the marginal effect of negative cash flows on firms above the median for each one of the cultural variables (column 2). The interaction terms are significant at the one-percent level, except the non-significant interaction of uncertainty avoidance. Considering the individualism variable, it is possible to notice that negative cash flow firms in countries that are more individualistic have fewer cash holdings than those firms in countries below the median. This is the expected relation, considering the overconfidence strictly connected to this national culture variable. The overconfidence skew managers' risk perception, reducing their demand for cash when comparing with countries with lower individualism. Further, the interaction between cash flow magnitude and masculinity reflects that firms in countries with levels of masculinity above the median hold less cash than firms in countries with lower levels of masculinity. Although firms in masculinity countries are more prone to hold larger cash holdings, this might indicate that managers do not adapt their investment behaviour according to the sign of cash flows. Moreover, the positive coefficient of the interaction term between uncertainty avoidance and cash flow magnitude is not significant in explaining the level of cash holdings for our sample. The table 8 also suggests that firms in more long-term oriented countries with negative cash flows hold more cash than firms in countires below the median in this dimension. To the extent that firms in long-term oriented countries may be overly conservative and managers tend to put less pressure on short-term gains, the results show that the impact of this national culture on cash holdings holds regardless the sign of firms' cash flow.

In column (3) we introduce again the variable representing the persistence of negative cash flows. The relation provide evidence that the persistence of negative cash flows increase the demand for cash, even considering the national culture.

Lastly, the marginal effect of negative cash flows for firms reporting persistent loses is addressed in column (4). According to individualism, masculinity and uncertainty avoidance,

we prove that persistent negative cash flow firms tend to hold more cash than non-persistent ones. The only exception is the case of long-term oriented countries, which their cash decreases when comparing to non-persistent negative cash flow firms. This might mean that managers decrease their cash holdings in order to take decisions to invert their cash flow sign. Indeed, as it is possible to see in column (4) the persistence of negative cash flow completely invert the relation of cash flow magnitude with each one of the national culture variables. This show the strength of cash flow in cash holdings decisions. For instance, as the case of column (2) the persistence of negative cash flows skew the overconfidence bias of firms in individualistic countries. In this case, the magnitude of impact of persistent negative cash flows is significant. In addition, our empirical evidence support the view that firms with persistent negative cash flows in masculinity countries hold more cash to be able to pursuit their personal decisions without any external judgment. The interaction variable between cash flow magnitude and both the uncertainty avoidance and long-term orientation is not significant in our study.

Considering the empirical literature mentioned, individualism, masculinity and long-term orientation influence the cash holding decisions. Accordingly, we show through the previous results that the national culture have an important role in determining the level of cash holdings in firms reporting losses.

5.2.1. Firm Risk Attributes

In order to test additional effects of national culture variables, we decide to analyze further relations. Therefore, we examine the marginal effect of risk in cash holdings, considering the national cultures. To do so, we apply the interaction between cultural dimensions and two risk firm characteristics. We use cash flow volatility, as firms with higher volatile cash flows are more prone to face financial distress in the future. Considering that firms with greater R&D are assumed to have higher costs of financial distress, we also interact this variable with national culture dimensions. Actually, the literature states that firms with higher cash flow volatility and R&D hold more precautionary cash. Results are shown in Table 9.

Table 9: Estimation Output of Risk Firm Characteristics

Independent Variable	**(1)**	**(2)**
Constant	0.2803***	0.2481***
	(0.0054)	(0.0046)
$CFLOW_t$	0.1304***	0.1739***
	(0.0219)	(0.0206)
$CFMAGN_t$	-0.2338***	-0.2319***
	(0.0252)	(0.0264)
$I(CFNEG)_t$	0.0111***	0.0079***
	(0.0021)	(0.0020)
$ICFVOL_t$		0.1918***
		(0.0089)
$FSIZE_t$	-0.0049***	-0.0042***
	(0.0005)	(0.0004)
LEV_t	-0.7307***	-0.6989***
	(0.0107)	(0.0101)
LEV^2_t	0.8327***	0.8001***
	(0.0141)	(0.0137)
$INVOP_t$	0.0234***	0.0205***
	(0.0018)	(0.0015)
$CAPEX_t$	-0.2816***	-0.2670***
	(0.0088)	(0.0088)
$I(DIV)_t$	-0.0049***	-0.0020
	(0.0018)	(0.0016)
$I(RDI)_t$	0.0561***	0.0141***
	(0.0025)	(0.0025)
IDV_M	-0.0399***	-0.0427***
	(0.0037)	(0.0032)
MAS_M	0.0068***	0.0116***
	(0.0017)	(0.0016)
UAI_M	0.0136***	0.0169***
	(0.0035)	(0.0027)
LTO_M	0.0031	0.0062***
	(0.0020)	(0.0017)
$IDV\_M*CFVOL_t$	0.1007***	
	(0.0131)	
$MAS\_M*CFVOL_t$	0.0635***	
	(0.0141)	
$UAI\_M*CFVOL_t$	0.0183	
	(0.0264)	
$LTO\_M*CFVOL_t$	-0.0669***	
	(0.0114)	
IDV_M*RDI_t		0.3133***
		(0.0234)
MAS_M*RDI_t		0.0992***
		(0.0222)
UAI_M*RDI_t		0.3411***
		(0.0304)
LTO_M*RDI_t		-0.0657***
		(0.0220)
R-squared	0.3472	0.3803

F-Statistic	6822.69	7073.54
Observations	335,355	335,355

Table 9 presents output estimation of the base empirical model (4.3.2.) through Double Clustered Model. In column (1) we present the equation model (4.3.2.). In column (2) we introduce the dummy variable $I(CFNEG)_{t-3}$, which takes the value of 1 if the three previous firm's cash flow were negative, and zero otherwise. In column (3) we include four interaction terms between the variable $CFMAGN_t$ and the four hofstede's cultural dimensions. The dependent variable is $CASH_t$, computed as cash and cash equivalents over total assets. $CFLOW_t$ is the ratio pre-tax profits plus depreciation over total assets. $CFMAGN_t$ is the interaction of an indicator of negative cash flow dummy with cash flow. $I(CFNEG)_t$ is a dummy variable set to one when cash flow is negative, and set to 0 otherwise. . $I(CFNEG)_{t-3t}$ is a dummy variable set to one when cash flow is negative in the previous three years, and set to 0 otherwise. $ICFVOL_t$ is the cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous five years. $FSIZE_t$ is the natural logarithm of sales. LEV_t is the ratio of total total debt to total assets. LEV^2_t is the squared term of leverage. $INVOP_t$ is the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets. $CAPEX_t$ is the ratio of capital expenditures to the book value of assets. $I(DIV)_t$ is a dummy variable that takes the value of one if the firm pay dividends and is set to zero otherwise. $I(RDI)_t$ is a dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise. IDV_M is Hofstede's individualism index that equals one for countries above the median, and zero otherwise. MAS_M is Hofstede's masculinity index that equals one for countries above the median, and zero otherwise. UAI_M is Hofstede's uncertainty-avoidance index that equals one for countries above the median, and zero otherwise. LTO_M is Hofstede's long-term orientation index that equals one for countries above the median, and zero otherwise. Robust standard errors to heteroscedasticity are reported in parenthesis under each coefficient. Statistically significance is represented by * at 10%, ** at 5% and *** at 1%.

The column (1) of the table 9 shows that the interaction variables are statistically significant at the one-percent level, with the exception of the non-significance of the interaction UAI*CFVOLt. In this regression, we decide to substitute the industry cash flow volatility by the firm cash flow volatility. Moreover, the coefficient of $IDV*CFVOL_t$, $MAS*CFVOL_t$ and $UAI* CFVOL_t$ is positive, while the coefficient of $LTO*CFVOL_t$ is negative. Indeed, despite the different magnitudes of the coefficients, the results of the interactions between the natural culture variables and R&D are similar. These results support the hypothesis that individualism, uncertainty avoidance and masculinity create an additional incentive for firms to hold cash when either cash flow volatility or R&D expenditures rises. Hence, we conclude that the national culture of a country influence firm's precautionary motive to hold cash.

5.3. The Role of Financial Constraints

We now turn our attention to the role of financial constraints on firms' cash holdings. Table 10 shows the estimated of equation (4.3.2.) with the sample divided according to the firms' financial constraints considering four criteria: KZ Index, WW Index, Firm Size and Dividend Payout.

Table 10: Estimation Output of Financial Constraints

	KZ Index		WW Index		Firm Size		Dividend Payout	
Independent Variables	**Constrained**	**Unconstrained**	**Constrained**	**Unconstrained**	**Constrained**	**Unconstrained**	**Constrained**	**Unconstrained**
Constant	-0.0553***	0.4140***	0.1687***	0.2342***	0.1445***	0.2139***	0.1618***	0.2406***
	(0.0063)	(0.0119)	(0.0226)	(0.0121)	(0.0212)	(0.0130)	(0.0129)	(0.0110)
$CFLOW_t$	-0.0141	0.1397***	0.1823***	0.1842***	0.2050***	0.1287***	0.1576***	0.3161***
	(0.0100)	(0.0231)	(0.0221)	(0.0319)	(0.0287)	(0.0272)	(0.0215)	(0.0320)
$CFMAGN_t$	-0.0394***	-0.2801***	-0.2970***	-0.3422***	-0.3255***	-0.2071***	-0.2704***	-0.3574***
	(0.0117)	(0.0290)	(0.0244)	(0.0370)	(0.0328)	(0.0282)	(0.0244)	(0.0406)
$I(CFNEG)_t$	-0.0023***	0.0292***	0.0137***	0.0103***	0.0168***	0.0076***	0.0119***	0.0127***
	(0.0008)	(0.0040)	(0.0020)	(0.0029)	(0.0028)	(0.0026)	(0.0017)	(0.0039)
$ICFVOL_t$	0.0980***	0.1545***	0.1851***	0.1218***	0.1933***	0.1298***	0.1997***	0.1716***
	(0.0095)	(0.0160)	(0.0150)	(0.0129)	(0.0152)	(0.0152)	(0.0107)	(0.0142)
$FSIZE_t$	0.0026***	-0.0125***	-0.0061***	-0.0034***	-0.0039***	-0.0017**	-0.0036***	-0.0052***
	(0.0004)	(0.0007)	(0.0014)	(0.0008)	(0.0014)	(0.0008)	(0.0008)	(0.0006)
LEV_t	0.0706***	-0.7954***	-0.8864***	-0.4951***	-0.9299***	-0.4931***	-0.7615***	-0.7246***
	(0.0124)	(0.0194)	(0.0200)	(0.0168)	(0.0204)	(0.0148)	(0.0171)	(0.0179)
LEV^2_t	-0.0768***	1.0770***	1.0044***	0.5536***	1.0847***	0.5469***	0.8518***	0.9702***
	(0.0170)	(0.0379)	(0.0262)	(0.0246)	(0.0270)	(0.0217)	(0.0228)	(0.0294)
$INVOP_t$	0.0163***	0.0168***	0.0261***	0.0188***	0.0248***	0.0195***	0.0279***	0.0111***
	(0.0009)	(0.0015)	(0.0014)	(0.0028)	(0.0017)	(0.0023)	(0.0014)	(0.0025)
$CAPEX_t$	0.0258***	-0.3774***	-0.3012***	-0.2769***	-0.3124***	-0.2559***	-0.2744***	-0.3940***
	(0.0050)	(0.0181)	(0.0115)	(0.0150)	(0.0126)	(0.0161)	(0.0094)	(0.0196)
$I(DIV)_t$	-0.0079***	-0.1049***	0.0036	-0.0311***	0.0042	-0.0192***	0.0112***	-0.0128***
	(0.0010)	(0.0067)	(0.0043)	(0.0025)	(0.0033)	(0.0020)	(0.0024)	(0.0037)
$I(RDI)_t$	0.0109***	0.0608***	0.0782***	0.0253***	0.0841***	0.0317***	0.0793***	0.0309***
	(0.0016)	(0.0031)	(0.0034)	(0.0027)	(0.0039)	(0.0027)	(0.0033)	(0.0026)
IDV_M	-0.0258***	-0.0704***	-0.0427***	-0.0431***	-0.0359***	-0.0448***	-0.0301***	-0.0489***

	(0.0015)	(0.0038)	(0.0062)	(0.0028)	(0.0056)	(0.0027)	(0.0037)	(0.0034)
MAS_M	0.0068***	0.0309***	0.0188***	0.0022	0.0169***	0.0018	0.0124***	0.0002
	(0.0012)	(0.0034)	(0.0034)	(0.0029)	(0.0031)	(0.0026)	(0.0017)	(0.0026)
UAI_M	0.0137***	0.0413***	0.0249***	0.0049	0.0339***	0.0009	0.0145***	0.0129***
	(0.0014)	(0.0039)	(0.0044)	(0.0038)	(0.0052)	(0.0034)	(0.0028)	(0.0029)
LTO_M	0.0096***	-0.0063*	0.0007	0.0192***	-0.0019	0.0164***	0.0029	0.0213***
	(0.0013)	(0.0032)	(0.0031)	(0.0026)	(0.0029)	(0.0027)	(0.0020)	(0.0023)
IDV_M*CFMAGN$_t$	-0.0458***	-0.1664***	-0.1414***	-0.1501**	-0.1453***	-0.0640	-0.1226***	-0.0381
	(0.0086)	(0.0315)	(0.0173)	(0.0635)	(0.0191)	(0.0462)	(0.0147)	(0.0856)
MAS_M*CFMAGN$_t$	-0.0070	0.0025	-0.0150	-0.1891***	-0.0194	-0.1044***	-0.0358***	-0.0934**
	(0.0091)	(0.0237)	(0.0145)	(0.0562)	(0.0153)	(0.0252)	(0.0129)	(0.0389)
UAI_M*CFMAGN$_t$	0.0145	0.0038	0.0140	-0.0957	0.0357*	0.0316	-0.0072	-0.0153
	(0.0143)	(0.0337)	(0.0172)	(0.0654)	(0.0214)	(0.0338)	(0.0180)	(0.0966)
LTO_M*CFMAGN$_t$	0.0416***	0.1262***	0.0341**	0.1346**	0.0308**	0.0389	0.0417***	0.0713*
	(0.0096)	(0.0208)	(0.0136)	(0.0570)	(0.0148)	(0.0266)	(0.0133)	(0.0421)
R-squared	0.1372	0.4110	0.3963	0.2764	0.3803	0.2691	0.3895	0.3238
F-Statistic	629.65	3616.46	2863.37	1451.82	2936.92	1388.22	3575.54	2530.97
Observations	100,597	100,619	100,597	100,619	100,619	100,597	148,027	100,43

Table 10 presents output estimation of the empirical model (4.3.2.) according to four financial constraints criteria: KZ Index, WW Index, Firm Size and Dividend Payout. The dependent variable is $CASH_t$, computed as cash and cash equivalents over total assets. $CFLOW_t$ is the ratio pre-tax profits plus depreciation over total assets. $CFMAGN_t$ is the interaction of an indicator of negative cash flow dummy with cash flow. $I(CFNEG)_t$ is a dummy variable set to one when cash flow is negative, and set to 0 otherwise. $ICFVOL_t$ is the cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous five years. $FSIZE_t$ is the natural logarithm of sales. LEV_t is the ratio of total total debt to total assets. LEV^2_t is the squared term of leverage. $INVOP_t$ is the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets. $CAPEX_t$ is the ratio of capital expenditures to the book value of assets. $I(DIV)_t$ is a dummy variable that takes the value of one if the firm pay dividends and is set to zero otherwise. $I(RDI)_t$ is a dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise. IDV is Hofstede's individualism index. IDV_M is Hofstede's individualism index that equals one for countries above the median, and zero otherwise. MAS is Hofstede's masculinity index. MAS_M is Hofstede's masculinity index that equals one for countries above the median, and zero otherwise. UAI is Hofstede's uncertainty-avoidance index. UAI_M is Hofstede's uncertainty-avoidance index that equals one for countries above the median, and zero otherwise. LTO is Hofstede's long-term orientation index. LTO_M is Hofstede's long-term orientation index that equals one for countries above the median, and zero otherwise. Robust standard errors to heteroscedasticity are reported in parenthesis under each coefficient. Statistically significance is represented by * at 10%, ** at 5% and *** at 1%.

Contrary to the results of Han and Qiu (2007), we find that cash flow volatility has a positive association with cash holdings of financially constrained firms, as well as with financially unconstrained firms. In fact, Han and Qiu (2007) found that, despite the positive and significant relation between cash holdings and cash flow volatility in constrained firms, the relation of unconstrained firms is insignificant. Our result shows that although with different magnitudes, cash flow volatility[18] positively affects both constrained and unconstrained firms. The magnitude of the coefficient is larger for constrained firms than for unconstrained, except in the case of the KZ Index. This means that the increase in cash holdings is larger among constrained firms if we consider a similar increase in cash flow volatility for constrained and unconstrained firms. Further, contradicting Almeida et al. (2004) the model shows the firm's propensity to save cash out of cash flows is positive and significant regardless of firms' financial condition. Again, this results hold for all the measures except for the KZ Index.

As shown in table 10, financial constraints affect the precautionary motive to hold cash. For instance, an increase in investment opportunities creates a greater demand for cash in constrained firms rather than in unconstrained. This confirms that constrained firms save cash today based on their perception of future investment opportunities. However, this might force firms to sacrifice valuable projects today, which can be costly. Opposite to that, unconstrained firms have less benefit in holding cash today. Moreover, split the sample into financial constrained and unconstrained firms also has an impact on the dummy variable dividends. According to the model, financially constrained firms that pay dividends show the tendency to hold more cash, while unconstrained firms hold less cash. Nonetheless, this relation is only significant using the dividend payout measure. This leads us to the ambiguous relation mentioned in the literature. In this case, the relation might show the concern of financially constrained firms with the signaling hypothesis. Lastly, constrained firms show a higher impact of R&D intensity in their cash policy rather than unconstrained firms. This is the expected result given the joint between the fewer possibilities of constrained firms to access external capital and the lower asset tangibility of R&D expenditures.

Using financial constraints criteria's also exert an influence over the national culture variables regarding firms' cash policy. Even firms in countries where managers suffer more from

[18] It is important to note that some authors, as the case of Bates et al. (2009) connect the historical huge increase in cash ratios to the increase in industry cash flow volatility.

overconfidence (individualistic countries), unconstrained firms opt to hold less cash rather than constrained firms. Although this relation is negative and significant using all the four criteria, the magnitude of the decrease in cash holdings in individualistic countries is lower among constrained firms. This displays the increase in the precautionary demand for cash of firms, even in individualistic countries. In masculinity societies, constrained firms hold more cash than unconstrained ones. In fact, the greater impact might result from the need to avoid being subject to the market, therefore holding more cash allows managers of constrained firms to keep their investment. Nevertheless, this cultural variable does not have statistical impact on unconstrained firms. The cultural dimension uncertainty avoidance is only significant for both constrained and unconstrained firms according to the KZ Index and the Dividend Payout criteria. According to these criteria, the variable is significant and positive at the one-percent level. However, considering the WW Index and the Firm Size measures, the variable is only significant for constrained firms, showing that firms in high uncertainty-avoidance countries hold more cash. Finally, the long-term orientation show results that are not consistent across the four financially constrained criteria. This variable is only significant for unconstrained firms, displaying a positive relation. This means that firms in long-term oriented countries that are financially unconstrained tend to hold more cash than in short-oriented countries.

We decide to go further on our analysis and introduce the study of the marginal effect of negative cash flows among constrained and unconstrained firms for national culture variables. According to the results in table 10, constrained and unconstrained firms with negative cash flows hold more cash in individualistic countries than in collectivist countries. Actually, considering the KZ Index and WW Index, the magnitude of the negative coefficient is higher for unconstrained firms, which means that constrained firms with negative cash flows in individualistic countries hold more cash. This might indicate the effect of overconfidence is moderated among constrained firms comparing with unconstrained firms. For the interaction between masculinity countries and cash flow magnitude, only the dividend payout criteria display significant relation for both constrained and unconstrained segment of firms. In parallel with the WW Index and the Firm Size, the Dividend Payout criteria shows that unconstrained firms with negative cash flows in masculinity countries hold less cash than feminist countries. However, firms with negative cash flows that are constrained tend to hold more cash than unconstrained firms in masculinity societies. Furthermore, the interaction between uncertainty avoidance countries and cash flow

magnitude is not significant, except for constrained firms in firm size criteria. The interaction variable, which is significant at the ten-percent level, proves that constrained firms with negative cash flows in uncertainty avoidance countries hold more cash than in less uncertainty avoidance environments. Lastly, firms with negative cash flows in long-term oriented countries hold more cash than in short-term oriented countries. This relation holds for both constrained and unconstrained firms. Nonetheless, according to the firm size criteria the relation is non-significant for unconstrained firms.

The results that we got from the KZ index in this model are not inexplicable. In fact, Hadlock and Pierce (2010) provided doubts on the validity of the KZ Index as a measure of financial constraints. In their study, they find that only two components out of five are consistently related to constraints in their sample.

In sum, in firms where financing constraints are present the financial flexibility is more valued. These constraints have the capacity to affect the marginal costs and benefits of projects according to the firm's financial condition. Almeida et al. (2014) refer that managers tend to anticipate future frictions and adjust their cash policies in order to minimize the impact. In line with this, we provide evidence that the firm's financial position affects their cash policy decisions.

5.4. Robustness Tests

In order to verify the evidence reported, we provide a series of robustness tests in this section. First, we decide to change the dependent variable in the model. Considering this, we compute the cash ratio through the ratio of cash and cash equivalents to net assets, where net assets is the difference between total assets and cash and cash equivalents. This method is used by Opler et al. (1999) and Ferreira and Vilela (2004). In addition, we apply the approach used by Foley et al. (2007), Bates et al. (2009) and Dudley and Zhang (2016), which is the logarithm of cash and cash equivalents to net assets. Then, we regress the equation substituting the variable firm size ($FSIZE_t$_2). We follow several authors (Kim et al., 1998; Opler et al., 1999; Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004; Bates et al., 2009; Dennis and McKeon, 2017) and use as a proxy to firm size the natural logarithm of total assets. Lastly, we perform tests regarding the national culture variables. Over the years, several authors have challenged the applicability and reliability of Hofstede's scores. One major problem appointed is the failure to capture the changes of culture values over time

(Kirkman et al., 2006). However, the cultural dimensions as presented by Hofstede have a greater impact than other competing cultural variables (e.g. Schwartz, 1994). We use the framework of Tang and Koveos' (2008), which update Hofstede's cultural dimensions based on the changing in economic environments within countries. Indeed, there is evidence proving the dynamics of culture factors over years (e.g. Heuer, Cummings, and Hutabaratt, 1999)[19]. Although uncertainty avoidance and masculinity reflect more stable institutional traditions (e.g. language, religion, and geography) than the GDP per capita, which means that are less prone to change over time, Tang and Koveos' (2008) found a curvilinear relationship of GDP per capita with individualism and long-term orientation. This means that it is important to update Hofstede's cultural dimensions when there are changes in economic conditions.

In table 11, we present the output of the regressions estimations for our robustness conditions, based on the equation (4.3.2.):

[19] Heuer, Cummings, and Hutabaratt (1999) found evidence that the difference regarding power distance and individualism between Indonesian and US managers has declined in the previous years.

Table 11: Estimation Output of Robustness Checks

Independent Variable	(1)	(2)	(3)	(4)
Constant	0.6253***	-2.6701***	0.1720***	0.2212***
	(0.0256)	(0.0812)	(0.0065)	(0.0120)
$CFLOW_t$	0.3765***	1.3981***	-0.2949***	0.1837***
	(0.0691)	(0.1575)	(0.0288)	(0.0189)
$CFMAGN_t$	-0.5399***	-1.7263***	0.0110***	-0.1938***
	(0.0862)	(0.2062)	(0.0020)	(0.0218)
$I(CFNEG)_t$	0.0912***	0.2084***	0.2263***	0.0352***
	(0.0084)	(0.0178)	(0.0088)	(0.0025)
$ICFVOL_t$	0.0773***	0.3649***	0.1419***	0.0108***
	(0.0086)	(0.0343)	(0.0258)	(0.0014)
$FSIZE_t$	-0.0325***	0.0039		-0.0082***
	(0.0016)	(0.0056)		(0.0005)
$FSIZE_t\_2$			-0.0019***	
			(0.0004)	
LEV_t	-0.9802***	-4.5439***	-0.7386***	-0.4390***
	(0.0251)	(0.1017)	(0.0108)	(0.0082)
LEV^2_t	0.6013***	3.0104***	0.8496***	0.2625***
	(0.0362)	(0.1082)	(0.0145)	(0.0091)
$INVOP_t$	0.0549***	0.1441***	0.0235***	0.0184***
	(0.0044)	(0.0107)	(0.0020)	(0.0009)
$CAPEX_t$	-0.9148***	-1.8011***	-0.2872***	-0.2793***
	(0.0358)	(0.0943)	(0.0099)	(0.0097)
$I(DIV)_t$	-0.0270***	-0.0525**	-0.0095***	-0.0102***
	(0.0046)	(0.0213)	(0.0016)	(0.0022)
$I(RDI)_t$	0.1437***	0.5279***	0.0517***	0.0562***
	(0.0097)	(0.0191)	(0.0024)	(0.0032)
IDV	0.0346***	-0.3425***	-0.0313***	0.0341***
	(0.0119)	(0.0484)	(0.0035)	(0.0041)
MAS	0.0821***	0.6101***	0.0517***	-0.0223***
	(0.0123)	(0.0453)	(0.0054)	(0.0057)
UAI	0.0232	0.0215	0.0033	0.0558***
	(0.0142)	(0.0666)	(0.0059)	(0.0100)
LTO	0.0692***	0.9566***	0.0604***	0.0645***
	(0.0114)	(0.0371)	(0.0041)	(0.0036)
R-squared	0.2360	0.2801	0.3477	0.3165
F-Statistic	2917.61	9046.79	8189.19	6886.51
Observations	351,613	351,613	335,355	321,592

Table 11 presents output estimation of the robustness tests. In column (1) and (2) we change the dependent variable. In column (3) we change the measure of firm size, while in column (4) we compute the national culture variables according to Tang and Koveos'(2008). The dependent variable in column (1) CASH_2 is measured as the ratio of cash and cash equivalents over net assets, where net assets is the difference between total assets and cash and cash equivalents. The dependent variable in column (2) CASH_3 is measured as the natural logarithm of the ratio of cash and cash equivalents over net assets. The dependent variable in column (3) and (4) is $CASH_t$, computed as cash and cash equivalents over total assets. $CFLOW_t$ is the ratio pre-tax profits plus depreciation over total assets. $CFMAGN_t$ is the interaction of an indicator of negative cash flow dummy with cash flow. $I(CFNEG)_t$ is a dummy variable set to one when cash flow is negative, and

set to 0 otherwise. $ICFVOL_t$ is the cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous five years. $FSIZE_t$ is the natural logarithm of sales. $FSIZE_t\_2$ is the natural logarithm of total assets. LEV_t is the ratio of total total debt to total assets. LEV^2_t is the squared term of leverage. $INVOP_t$ is the ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets. $CAPEX_t$ is the ratio of capital expenditures to the book value of assets. $I(DIV)_t$ is a dummy variable that takes the value of one if the firm pay dividends and is set to zero otherwise. $I(RDI)_t$ is a dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise. In column (1), (2) and (3) IDV is Hofstede's individualism index. MAS is Hofstede's masculinity index. UAI is Hofstede's uncertainty-avoidance index. LTO is Hofstede's long-term orientation index. In column (4) IDV is Tang and Koveos' (2008) individualism index. MAS is Tang and Koveos' (2008) masculinity index. UAI is Tang and Koveos' (2008) uncertainty-avoidance index. LTO is Tang and Koveos' (2008) long-term orientation index. Robust standard errors to heteroscedasticity are reported in parenthesis under each coefficient. Statistically significance is represented by * at 10%, ** at 5% and *** at 1%.

In columns (1) and (2) we change the dependent variables, either to the ratio of cash and cash equivalents to net assets and the logarithm of cash and cash equivalents over net assets. Then, we substitute the independent variable firm size in condition (3). Finally, the condition (4) update the original Hofstede's cultural dimensions (1980, 2001) based on the study of Tang and Koveos' (2008).

Substituting the dependent variable in the empirical model produces slightly different results in condition (1) and (2). In contrast with our model, the first difference is in the variable firm size, which becomes positive in the second condition. However, the variable loses its statistical significance. The condition (1) change the coefficient signal of the cultural dimension individualism. According to the model in this condition, individualistic countries tend to hold more cash. It is also possible to notice that changing the method to compute the dependent variable (condition 1 and condition 2) do not change the statistical significance of uncertainty-avoidance cultural dimension. Indeed, the variable do not have statistical strength to explain the level of cash holdings. Regarding the remaining variables, there are no statistically significant differences among variables in both conditions. Moreover, the R-squared suggest that our model is substantially more appropriate to explain the behaviour of our dependent variable. The condition (3) suggest that either ways of computing firm size produce a negative coefficient, that is statistically significant at the one-percent level. Although this condition suggests a positive association between cash holdings and uncertainty-avoidance, the variable is not statistically significant. Concerning the condition

(4) we eliminate from the sample countries[20] which national culture variables were not updated by Tang and Koveos' (2008). In this condition, the financial variables maintain the same coefficients and levels of significance. The only difference is in the national culture variables. According to the Tang and Koveos' (2008) updated dimensions, individualism has a positive association with cash ratio, while masculinity has a negative relationship. In addition, the variable uncertainty avoidance becomes positive and statistically significant at the one-percent level.

In general, the robustness test supports the conclusion drawn from the main models, despite highlighting some weakness in two Hofstede's cultural dimensions, individualism, and masculinity.

[20] The countries that we removed from our sample were Czech Republic, China, Hungary, Morocco, Poland, Russia and Taiwan.

6. Conclusion

The present study investigates how corporate cash holdings of 45 countries are influenced by losses, using a panel data for the period between 1992 and 2016. We include in our study Hofstede's cultural dimensions (1980, 2001) since prior studies do not inform on the impact of culture variables for firms reporting losses. This allows providing insights on whether the effect of national culture variables varies according the sign of cash flows. Additionally, we attempt to comprehend the response of cash holdings to variations of constrained firm's volatility, as well the impact of constraints on cultural variables.

Our results suggest a positive and statistically significant relation of cash holdings with cash flow, the existence of negative cash flow, cash flow volatility, higher levels of leverage, investment opportunities, payment of dividends and R&D intensity. In contrast, the magnitude of cash flows, firm size, lower levels of leverage and capital expenditures impacts negatively on cash holdings. These variables are statistically significant and in accordance with the majority of the available literature, supporting the hypothesis that both the transaction and precautionary explains the level of cash holdings of firms reporting losses.

Concerning the national culture variables, we find that firms in masculinity, uncertainty avoidance and long-term oriented countries tend to hold larger amounts of cash, while the relation is inverse in individualistic countries. However, we also provide evidence that the magnitude of negative cash flows affects cultural variables. Mainly, firms in masculinity countries with negative cash flows have less cash than feminist societies, while the overconfidence bias associated with individualistic countries keeps the impact on manager's decision even in negative cash flow firms. According to our study, the interaction term between uncertainty avoidance countries and losses is not significant in explaining the level of cash.

Finally, we argue that firm's financial constraint position influence their cash policy decisions. Contrary to Han and Qiu (2007), we evidence that, although with different magnitudes, both constrained and unconstrained firms response positively in terms of cash holdings against cash flow volatility variations. The results suggest a positive relation of masculinity, uncertainty avoidance and long-term orientation with cash holdings, while a negative relation of individualism regardless firm's financial condition. Further, we report evidence that the

effect of individualism is moderated by firm's financial position, as unconstrained firms with negative cash flows in highly individualistic countries hold less cash. In this regard, the impact on cash holdings of firms with negative cash flow firms in long-term oriented countries is lower for constrained firms than for unconstrained firms.

Our evidence supports the hypothesis of an additional precaution regarding cash holdings of firms reporting losses, exacerbated when these losses are persistent. We do not find enough evidence supporting that any of the main theories of cash is completely consistent with our results.

In order to correctly access the country's national culture and firm's financial constraints, we use the most common methods presented in the empirical literature. However, the literature is not clear about which method is more suitable and reliable to proxy both financial constraints and national dimensions. This poses the main limitation of our study. Regarding national culture variables we use Hofstede's study (1980, 2001), although Tang and Koveos' (2008) cultural indices, Globe Research project and Schwartz (1994) cultural dimensions are also well-known methods applied to deal with national culture. According to Kirkman et al. (2006), Hofstede's cultural factors has been criticized because it reduces the term culture to five dimensions, limiting the sample to only one multinational corporation and fails to capture the flexibility of culture over time. Some doubts were also raised related to the validity of Hofstede's cultural dimensions, considering that the data were gathered in the 1960s and 1970s. However, Kirkman et al. (2006) not only refer that recent research confirms the validity of Hofstede conclusion, but also that the framework is the most comprehensive to analyze the effect of national culture on corporate financial decisions.

Regarding financial constraints, we follow several proxies in order to get more robust conclusions (Almeida et al., 2004; Kaplan and Zingales, 1997; Whited and Wu, 2006). Even though these are recognized methods, the literature has numerous alternatives, as the case of Hadlock and Pierce (2010). Albeit, as discussed in section (4.4.1) there still no consensus in the literature about the perfect model to access financial constraints.

Regarding future research suggestions, it would be important to develop a more detailed study including governance factors to test the possible association with cash holdings of firms reporting losses. Moreover, we consider that an analysis of the impact of financial crisis on firms reporting losses during our sample period would be important to understand how firms adapt their cash to these negative events.

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Appendix

Appendix A – Variables Description

Table A. 1: Description of variables

$CASH_t$	Cash and cash equivalents over total assets.
$CASH_t$_2	Ratio of cash and cash equivalents over net assets, where net assets is the difference between total assets and cash and cash equivalents.
$CFLOW_t$	Ratio pre-tax profits plus depreciation over total assets.
$CFMAGN_t$	Interaction of an indicator of negative cash flow dummy with cash flow.
$I(CFNEG)_t$	Dummy variable set to one when cash flow is negative, and set to 0 otherwise.
$I(CFNEG)_{t-3}$	Dummy variable set to one when cash flow is negative in t-1, t-2 and t-3, and set to 0 otherwise.
$CFVOL_t$	Cash flow standard deviation computed based on the average of the cash flow standard deviation of the previous ten years.
$ICFVOL_t$	Cash flow standard deviation for each two-digit SIC code, computed based on the average of the cash flow standard deviation of the previous ten years.
$FSIZE_t$	Natural logarithm of sales.
$FSIZE_t$_2	Natural logarithm of total assets.
LEV_t	Ratio of total total debt to total assets.
LEV^2_t	Squared term of leverage.
$INVOP_t$	Ratio of the book value of assets minus the book value of equity plus the market value of equity over the book value of assets.
$CAPEX_t$	Ratio of capital expenditures to the book value of assets.
$I(DIV)_t$	Dummy variable that takes the value of one if the firm pay dividends and is set to zero otherwise.
$I(RDI)_t$	Dummy variable set to 1 if the ratio of research and development over total assets is higher than 0.02, and is set to 0 otherwise.
IDV	Hofstede's individualism index.
IDV_M	Hofstede's individualism index that equals one for countries above the median, and zero otherwise.
MAS	Hofstede's masculinity index.
MAS_M	Hofstede's masculinity index that equals one for countries above the median, and zero otherwise.
UAI	Hofstede's uncertainty-avoidance index.
UAI_M	Hofstede's uncertainty-avoidance index that equals one for countries above the median, and zero otherwise.
LTO	Hofstede's long-term orientation index.
LTO_M	Hofstede's long-term orientation index that equals one for countries above the median, and zero otherwise.

Appendix B – Summary Statistics

Table B. 1: Observations by Country

The table report firm-year observation for each country included in the study.

	Firm-Year Observations	Percentage
Argentina	333	0.10
Australia	13,623	4.06
Austria	524	0.16
Belgium	1,26	0.38
Brazil	2,297	0.68
Canada	9,898	2.95
Chile	1,498	0.45
China	12,817	3.82
Colombia	44	0.01
Denmark	1,839	0.55
Finland	1,79	0.53
France	7,869	2.35
Germany	7,102	2.12
Greece	2,458	0.73
Hong Kong	10,502	3.13
Hungary	8	0.00
India	17,997	5.37
Indonesia	3,866	1.15
Ireland	524	0.16
Israel	2,478	0.74
Italy	2,674	0.80
Japan	58,618	17.48
Malaysia	11,182	3.33
Mexico	1,366	0.41
Morocco	63	0.02
Netherlands	2,34	0.70
New Zealand	939	0.28
Norway	1,956	0.58
Pakistan	1,963	0.59
Philippines	1,204	0.36
Poland	2,74	0.82
Portugal	423	0.13
Russia	1,015	0.30
Singapore	6,903	2.06
South Africa	3,712	1.11
South Korea	16,407	4.89
Spain	1,554	0.46
Sweden	4,093	1.22
Switzerland	2,796	0.83
Taiwan	18,083	5.39
Thailand	5,924	1.77
Turkey	2,502	0.75
United Kingdom	21,234	6.33
United States	66,932	19.96
Venezuela	5	0.00

Table B. 2: National Culture Values by Country

The table report the mean values for each of the national culture values included in the study. Values are displayed by country.

	IDV	MAS	UAI	LTO
Argentina	46	56	86	20
Australia	90	61	51	21
Austria	55	79	70	60
Belgium	75	54	94	82
Brazil	38	49	76	44
Canada	80	52	48	36
Chile	23	28	86	31
China	20	66	30	87
Colombia	13	64	80	13
Denmark	74	16	23	35
Finland	63	26	59	38
France	71	43	86	63
Germany	67	66	65	83
Greece	35	57	112	45
Hong Kong	25	57	29	61
Hungary	80	88	82	58
India	48	56	40	51
Indonesia	14	46	48	62
Ireland	70	68	35	24
Israel	54	47	81	38
Italy	76	70	75	61
Japan	46	95	92	88
Malaysia	26	50	36	41
Mexico	30	69	82	24
Morocco	46	53	68	14
Netherlands	80	14	53	67
New Zealand	79	58	49	33
Norway	69	8	50	35
Pakistan	14	50	70	50
Philippines	32	64	44	27
Poland	60	64	93	38
Portugal	27	31	104	28
Russia	39	36	95	81
Singapore	20	48	8	72
South Africa[21]	65	63	49	34
South Korea	18	39	85	100
Spain	51	42	86	48
Sweden	71	5	29	53
Switzerland	68	70	58	74
Taiwan	17	45	69	93
Thailand	20	34	64	32
Turkey	37	45	85	46
United Kingdom	89	66	35	51
United States	91	62	46	26
Venezuela	12	73	76	16

[21] We joint together the two South Africa present in Hofstede's study. Individualism, Masculinity and Uncertainty Avoidance are from Normal South Africa, while Long-Term Orientation is from White South Africa.

Table B. 3: Collinearity Statistics - VIF Test

The table report the outputs of the estimation of the variance inflation factor.

Independent Variable	VIF
CFLOW	2.06
I(CFNEG)	2.06
ICFVOL	1.48
FSIZE	1.51
LEV	1.21
INVOP	1.13
CAPEX	1.08
I(DIV)	1.43
I(RDI)	1.12
IDV	2.45
MAS	1.44
UAI	1.53
LTO	2.83

Table B. 4: Mean Cash Ratio

The table report the evolution of average cash holdings, measured as the ratio of cash over net assets, by year for the sample of 335,355 firm-year observations, from 1992 to 2016. Values are an average over firm-year observations within each decile.

Year	Cash/Net Assets
1992	0.3143
1993	0.3356
1994	0.3294
1995	0.3200
1996	0.3092
1997	0.3204
1998	0.3177
1999	0.3157
2000	0.3172
2001	0.3185
2002	0.3358
2003	0.3400
2004	0.3408
2005	0.3381
2006	0.3339
2007	0.3328
2008	0.3229
2009	0.3380
2010	0.3360
2011	0.3346
2012	0.3302
2013	0.3253
2014	0.3261
2015	0.3345
2016	0.3328